144MHz FM TRANSCEIVER

TM-241A/E

SERVICE MANUAL

KENWOOD

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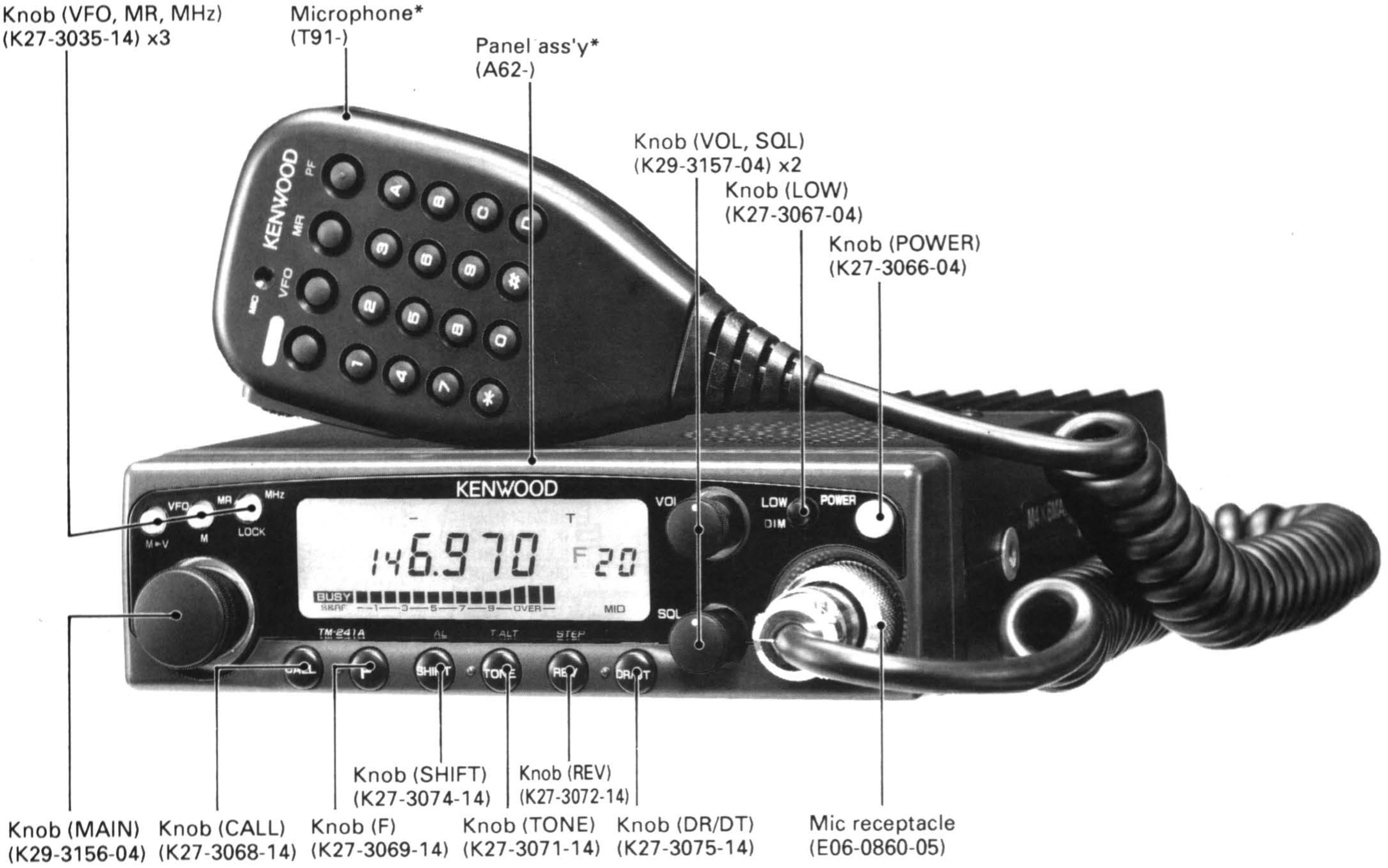
Knob (VFO, MR, MHz)
(K27-3035-14) x3
Microphone*
(T91-)
Panel ass'y*
(A62-)
Knob (VOL, SQL)
(K29-3157-04) x2
Knob (LOW)
(K27-3067-04)
Knob (POWER)
(K27-3066-04)
KENWOOD
VFO
MR
MHz
M►V
M
LOCK
146.970
F 20
BUSY
VOL
SQL
LOW
DIM
POWER
MID
TM-241A
CALL
F
SHIFT
TONE
REV
DR/DT
Knob (SHIFT)
(K27-3074-14)
Knob (REV)
(K27-3072-14)
Knob (MAIN)
(K29-3156-04)
Knob (CALL)
(K27-3068-14)
Knob (F)
(K27-3069-14)
Knob (TONE)
(K27-3071-14)
Knob (DR/DT)
(K27-3075-14)
Mic receptacle
(E06-0860-05)

Photo is TM-241A.
*** Refer to parts list on page 15.**

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CIRCUIT DESCRIPTION

Circuit Configuration By Frequency

The TM-241A/E incorporates a PLL synthesizer which uses a digital VFO to allow any channel step of 5, 10, 12.5, 15, 20, or 25kHz to be selected (See Figure 1).

The receiving system utilizes double-conversion techniques. That is, an incoming signal is mixed down to the 1st intermediate frequency (IF) of 10.7MHz (K,P,X,M,M2,M3,E,E2,E9,EM), 30.825MHz (K2,P2), using a 1st local oscillator frequency of from 133.300 to 135.295MHz (E,E9,EM), 133.300 to 137.295MHz (M), 125.300 to 163.295MHz (K,P,X,M2,M3,E2), 105.175 to 166.820MHz (K2,P2). The 1st IF signal is then mixed with the 2nd local oscillator frequency of 10.245MHz (K,P,X,M,M2,M3,E,E2,E9,EM), 30.37MHz (K2,P2) to generate the 2nd IF of 455kHz.

The transmitting system consists of a PLL circuit which allows direct modulation and direct frequency division. Signals from the PLL circuit are amplified by a linear amplifier for transmission.

	TM-241A				TM-241E	
	K,P,X	K2,P2	M	M2,M3	E,E9,EM	E2
TX-RX UNIT (X57-369X-XX)	0-11	0-12	0-21	0-22	2-71	2-72

Table 1

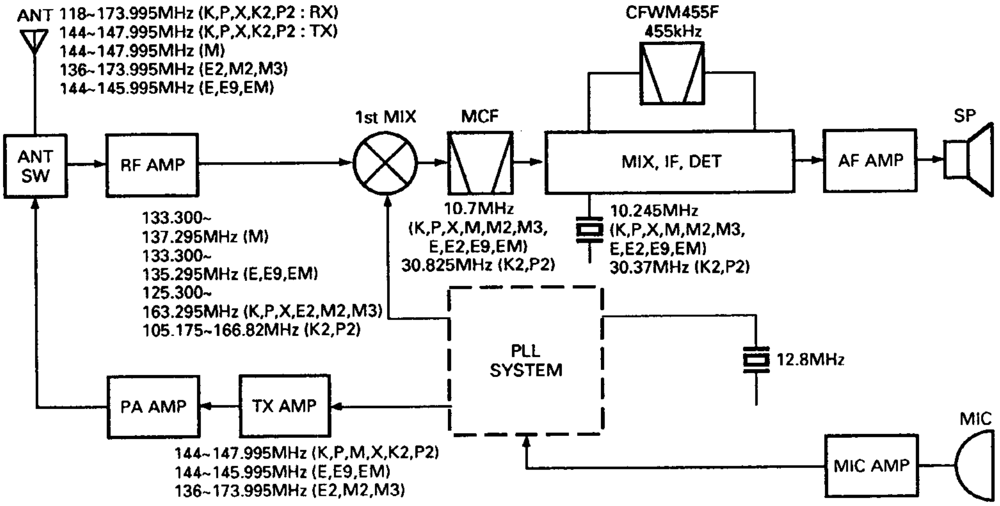

ANT
118~173.995MHz (K,P,X,K2,P2 : RX)
144~147.995MHz (K,P,X,K2,P2 : TX)
144~147.995MHz (M)
136~173.995MHz (E2,M2,M3)
144~145.995MHz (E,E9,EM)
ANT SW
RF AMP
1st MIX
MCF
CFWM455F
455kHz
MIX, IF, DET
AF AMP
SP
133.300~
137.295MHz (M)
133.300~
135.295MHz (E,E9,EM)
125.300~
163.295MHz (K,P,X,E2,M2,M3)
105.175~166.82MHz (K2,P2)
10.7MHz
(K,P,X,M,M2,M3,
E,E2,E9,EM)
30.825MHz (K2,P2)
10.245MHz
(K,P,X,M,M2,M3,
E,E2,E9,EM)
30.37MHz (K2,P2)
PLL
SYSTEM
12.8MHz
PA AMP
TX AMP
144~147.995MHz (K,P,M,X,K2,P2)
144~145.995MHz (E,E9,EM)
136~173.995MHz (E2,M2,M3)
MIC
MIC AMP

Fig. 1 Frequency configuration

Receiving System

• Overview

Incoming signals from the antenna pass through a low-pass filter in the final block of the transmitter system, and are switched to the front-end of the receiver system via a receive/transmit switching diode.

The signals are then passed through an antenna matching coil, where the high-frequency components are amplified by a GaAs FET. The signals are then fed into a three-stage band-pass filter that uses vari-cap tuning to reject unwanted signal components, and is fed to the 1st mixer. The 1st mixer uses the N-channel MOS FET that are used in the RF stage to obtain better two-signal characteristics. The 1st mixer mixes the signal with the 1st local oscillator frequency and converts it to the 1st IF (10.7MHz : K,P,X,M,M2,M3, E,E2,E9,EM, 30.825MHz : K2,P2). The signal then passes through two monolithic crystal filters (MCFs) to remove unnecessary near-by frequency components.

The signal from the MCFs is used as the 1st IF signal.

The 1st IF signal is amplified and fed into IC1 (KCD04) in the FM IF HIC. The IF signal is then mixed with the 2nd local oscillator frequency of 10.245MHz (K,P,X,M,M2,M3,E,E2,E9,EM), 30.37MHz (K2,P2) to generate the 2nd IF of 455kHz. The 455kHz signal is then passed through a six element ceramic filter (CFWM455F), and fed back into IC1 for additional amplification. The output signal from the IC1 is then fed into a power amplifier via the audio volume control for application to the speaker.

• S-meter circuit

S-meter control voltage from IC1 (KCD04) in the FM IF HIC is fed into the control unit. The CPU converters the voltage from an analog to digital signal in order to operate the LCD bar meter.

CIRCUIT DESCRIPTION

Item	Rating
Nominal center frequency (fo)	10.7MHz
Pass bandwidth	±7.5kHz or less at 3dB
Attenuation bandwidth	±25kHz or less at 40dB ±45kHz or less at 60dB
Ripple	1.0dB or less
Insertion loss	1.5dB or less
Guaranteed attenuation	70dB or more within ±1MHz Spurious 40dB or more at fo ~ fo+500kHz 80dB or more at fo – (900~920kHz)
Terminating impedance	3kΩ / 0pF

Table 2 MCF (L71-0228-15) TX-RX unit XF1 : K,P,M,M2,M3,X,E,E2,E9,EM

Item	Rating
Nominal center frequency (fo)	30.825MHz
Pass bandwidth	±7.5kHz or less at 3dB
Attenuation bandwidth	±28kHz or less at 40dB
Ripple	1.5dB or less
Insertion loss	3.0dB or less
Guaranteed attenuation	60dB or more within ±1MHz Spurious : 40dB or more
Terminating impedance	1.4kΩ / 1pF

Table 3 MCF (L71-0270-05) TX-RX unit XF1 : K2,P2

Item	Rating
Nominal center frequency	455kHz ± 1kHz
6dB bandwidth	±6kHz or more (from 455kHz)
50dB bandwidth	±12.5kHz or less (from 455kHz)
Ripple	3dB or less (within ±4kHz of 455kHz)
Insertion loss	6dB or less
Guaranteed attenuation	35dB or more (within ±100kHz of 455kHz)
I/O matching impedance	2.0kΩ

Table 4 Ceramic filter CFWM455F (L72-0372-05) TX-RX unit CF1

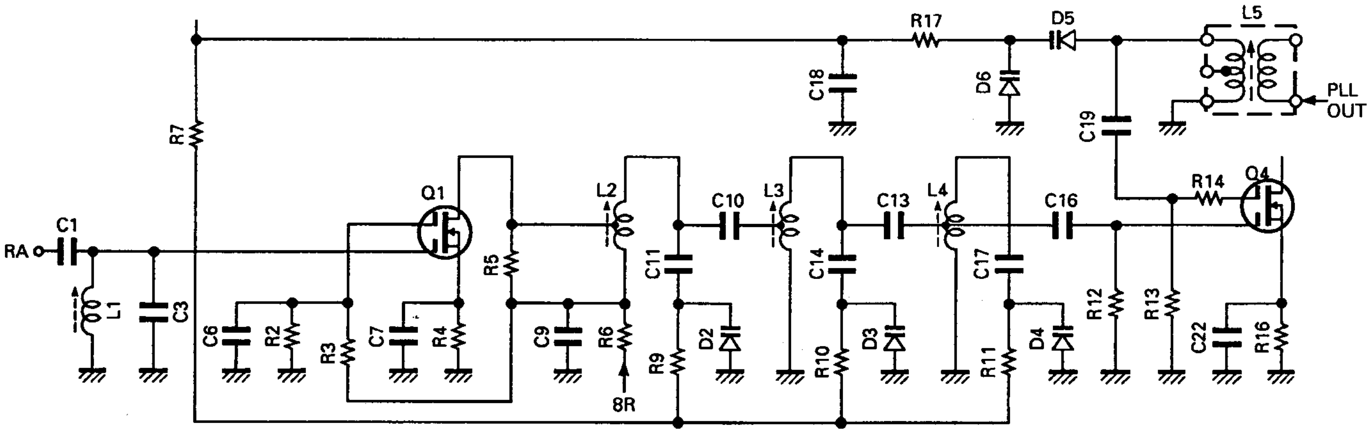

R17
D5
L5
C18
D6
C19
PLL OUT
R7
Q1
L2
C10
L3
C13
L4
C16
R14
Q4
C1
RA
L1
C3
C6
R2
R3
C7
R4
R5
C9
R6
8R
C11
R9
D2
C14
R10
D3
C17
R11
D4
R12
R13
C22
R16

Fig. 2 Front-end section (vari-cap tuning)

CIRCUIT DESCRIPTION

Transmitting System

- **Overview**

The transmitter produces the target frequency thru the use of direct FM-modulation via a varactor diode.

- **Modulation circuit**

Audio signals from the microphone are fed into the mic amplifier unit for amplification by the 1st transistor amplifier, and then into two operational amplifiers. The operational amplifiers form a splatter filter for pre-emphasis, amplification, limiting, and removal of unnecessary high-frequency components.

The FM modulation circuit directly FM-modulates the VCO signals, using a varactor diode.

- **Pre-amplifier stage circuit**

Signals from the VCO are applied to the drive HIC IC8 (KCB05). The amplifier always operates in a linear mode so that signals can be amplified without degradation. Additionally, the amplifier is designed to cover a wide range of frequencies and can produce stable output without adjustment. The APC (Automatic Power Control) controls collector voltage from the last stage of the pre-amplifier.

- **Power amplifier circuit**

The drive signal is amplified to the required level by the power module. The TM-241A/E uses a large heat sink for efficient heat dissipation.

- **APC circuit**

The APC circuit for automatic transmit output control detects part of the power module output, and amplifies it to provide a control voltage for output control. The output control voltage is in inverse proportion to the output from the power module, so it is maintained at the same level.

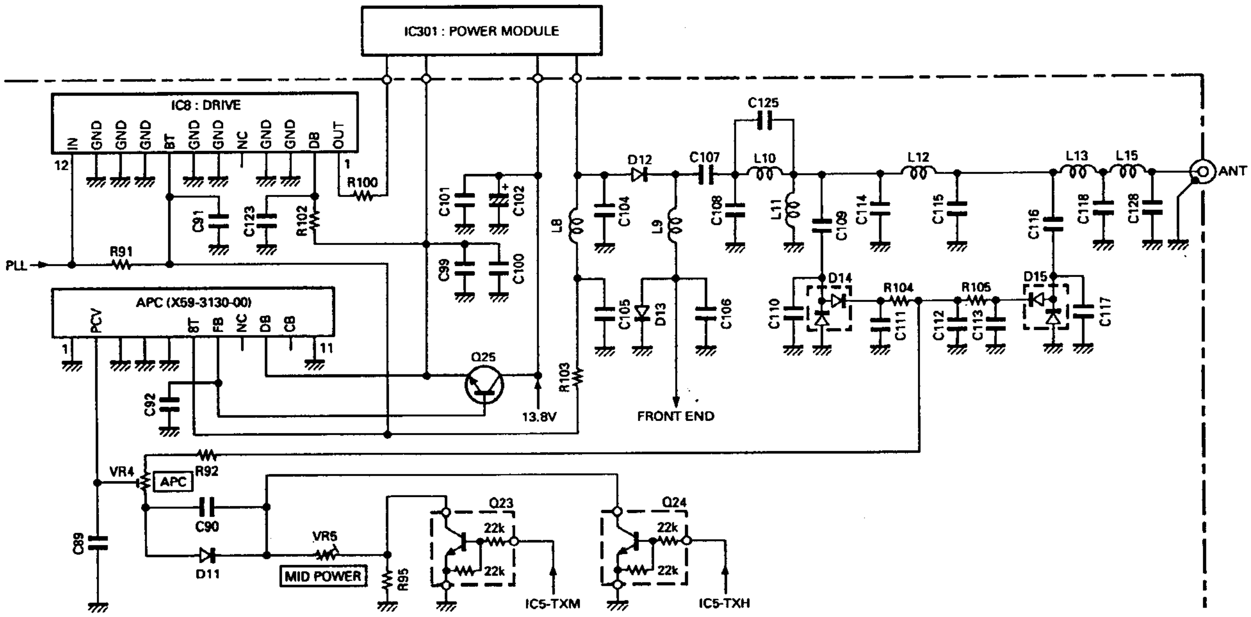

IC301 : POWER MODULE
IC8 : DRIVE
IN
GND
GND
GND
8T
GND
GND
NC
GND
GND
DB
OUT
12
1
R100
C91
C123
R102
PLL
R91
APC (X59-3130-00)
PCV
8T
FB
NC
DB
CB
1
11
C92
C101
C102
C99
C100
Q25
13.8V
R103
L8
C104
D12
C107
C125
L10
C108
L9
L11
C109
C114
L12
C115
L13
L15
C116
C118
C128
ANT
C105
D13
C106
FRONT END
C110
D14
R104
C111
R105
C112
C113
D15
C117
VR4
APC
R92
C90
D11
VR5
MID POWER
R95
C89
Q23
22k
22k
IC5-TXM
Q24
22k
22k
IC5-TXH

Fig. 3 Pre-amplifier stage, power amplifier, and APC circuits

(Tc = 25°C)

Item	Symbol	Condition	Rating	Unit
Operating voltage	V_{CC}		16	V
Control voltage	V_{CON}		16	V
Current consumption	I_T		14	A
Input power	Pi		600	mW
Output power	Po	$12.5V < V_{CC} \leq 16V$, $V_{CON} \leq 12.5V$ $P_i = 0 \sim 500mW$, $Z_G = Z_L = 50\Omega$	65	W
Operating case temperature	Tc(opr)		–30~+100	°C
Storage temperature	Tstg		–40~+110	°C

Table 5 Power module S-AV17 maximum ratings (IC301)

CIRCUIT DESCRIPTION

PLL Synthesizer Unit (K,P,X,M,M2,M3,E,E2,E9,EM)

Figure 4-1 is the PLL and VCO block diagram. In the TM-241A/E, the PLL system is implemented as a sub-unit which is divided into the upper VCO and lower PLL blocks. The sub-unit is shielded to prevent external interference.

There are two reference frequencies, 6.25kHz and 5kHz, available to allow 5, 10, 12.5, 15, or 25kHz-step operation. The 6.25kHz is obtained by dividing the reference oscillator frequency of 12.8MHz by 2048, and the 5kHz is obtained by dividing it by 2560. The VCO directly generates the dial frequency. This dial frequency is amplified once and then fed into a pulse swallow-type PLL IC for frequency division and phase comparison, in order to lock the frequency.

The PLL system is locked without switching between transmit mode and receive mode. By using a signal ("H" in transmit mode) from pin 11 of the PLL IC (M54959FP), the LPF is deactivated-activated by Q52 and Q53 only for the moment when the TM-241A/E enters transmit mode. This helps produce lock more rapidly than previous methods.

In 144MHz mode, fvco (RX) is calculated by the following formula;

$$\text{fvco} = (144 - 10.7) = \{(n \times 128) + A\} \times \text{fosc} \div R$$

where,

fvco : VCO output frequency
n : Binary value of the 10-bit programmable counter
A : Binary value of the 7-bit programmable counter
fosc : 12.8MHz reference frequency
R : Binary value of the 14-bit programmable counter
2560 (5, 10, 15, 20, or 25kHz step mode)
2048 (12.5kHz step mode)

In 5, 10, 15, 20, or 25kHz step mode,
n = 208 and A = 36.
Therefore, fvco is calculated as follows;

$$\begin{aligned}\text{fvco} &= \{(208 \times 128) + 36\} \times 12800 \div 2560 \\ &= (26624 + 36) \times 5 \\ &= 133300 = 133.300\text{MHz}\end{aligned}$$

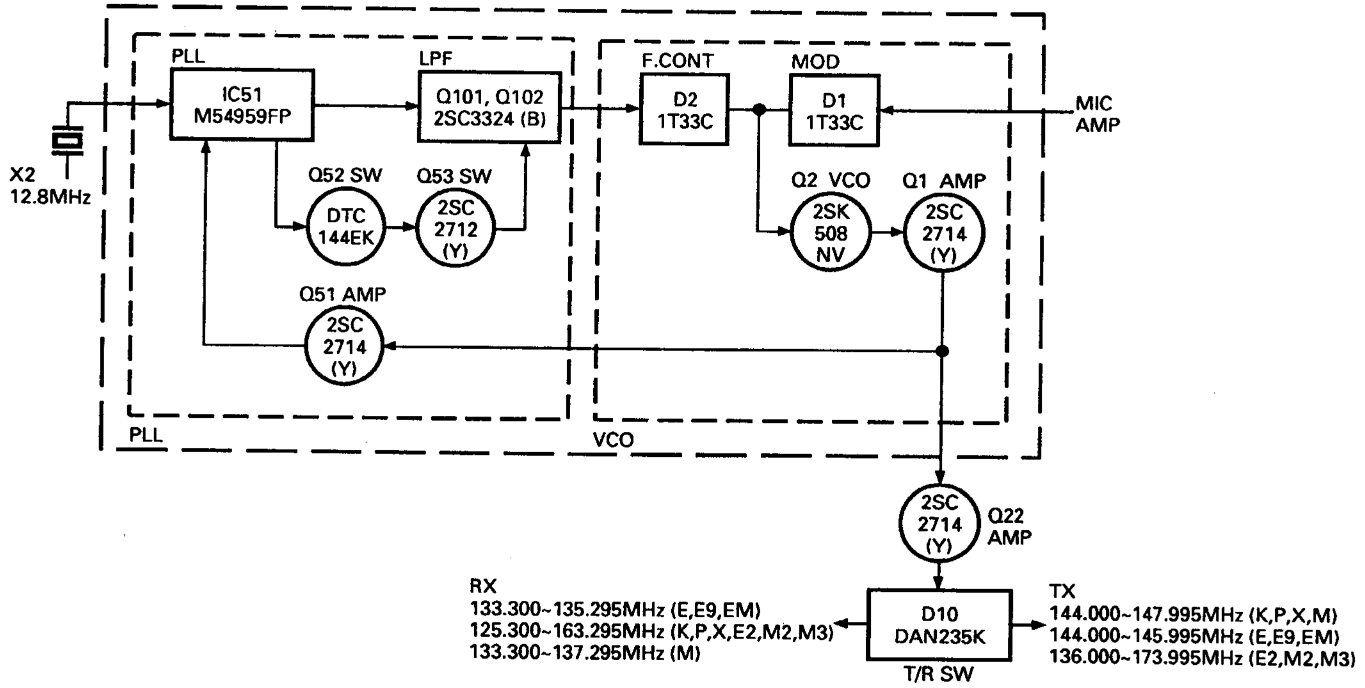

PLL
IC51
M54959FP
LPF
Q101, Q102
2SC3324 (B)
Q52 SW
DTC
144EK
Q53 SW
2SC
2712
(Y)
Q51 AMP
2SC
2714
(Y)
X2
12.8MHz
PLL
F.CONT
D2
1T33C
MOD
D1
1T33C
MIC
AMP
Q2 VCO
2SK
508
NV
Q1 AMP
2SC
2714
(Y)
VCO
2SC
2714
(Y)
Q22
AMP
D10
DAN235K
T/R SW
RX
133.300~135.295MHz (E,E9,EM)
125.300~163.295MHz (K,P,X,E2,M2,M3)
133.300~137.295MHz (M)
TX
144.000~147.995MHz (K,P,X,M)
144.000~145.995MHz (E,E9,EM)
136.000~173.995MHz (E2,M2,M3)

Fig. 4-1 PLL block diagram (K,P,X,M,M2,M3,E,E2,E9,EM)

CIRCUIT DESCRIPTION

PLL Synthesizer Unit (K2,P2)

Figure 4-2 is the PLL and VCO block diagram. In the TM-241A/E, the PLL system is implemented as a sub-unit which is divided into the upper VCO and lower PLL blocks. The sub-unit is shielded to prevent external interference.

There are two reference frequencies, 6.25kHz and 5kHz, available to allow 5, 10, 12.5, 15, or 25kHz-step operation. The 6.25kHz is obtained by dividing the reference oscillator frequency of 12.8MHz by 2048, and the 5kHz is obtained by dividing it by 2560. The VCO directly generates the dial frequency. This dial frequency is amplified once and then fed into a pulse swallow-type PLL IC for frequency division and phase comparison, in order to lock the frequency.

The PLL system has two VCOs, one for transmission and one for reception. Using a signal ("H" in transmit mode) from pin 10 of the PLL IC (M54959FP), the LPF is deactivated by Q105 only for the instant when the TM-241A/E enters transmit mode. This helps produce a more rapid PLL lock-up.

In 144MHz mode, fvco (RX) is calculated by the following formula;

$$\mathrm{fvco} = (144 - 30.825) = \{(n \times 128) + A\} \times \mathrm{fosc} \div R$$

where,

fvco : VCO output frequency
n : Binary value of the 10-bit programmable counter
A : Binary value of the 7-bit programmable counter
fosc : 12.8MHz reference frequency
R : Binary value of the 14-bit programmable counter
2560 (5, 10, 15, 20, or 25kHz step mode)
2048 (12.5kHz step mode)

In 5, 10, 15, 20, or 25kHz step mode,
$n = 176$ and $A = 107$.

Therefore, fvco is calculated as follows;

$$\begin{aligned}\mathrm{fvco} &= \{(176 \times 128) + 107\} \times 12800 \div 2560\\ &= (22528 + 107) \times 5\\ &= 113175 = 113.175\mathrm{MHz}\end{aligned}$$

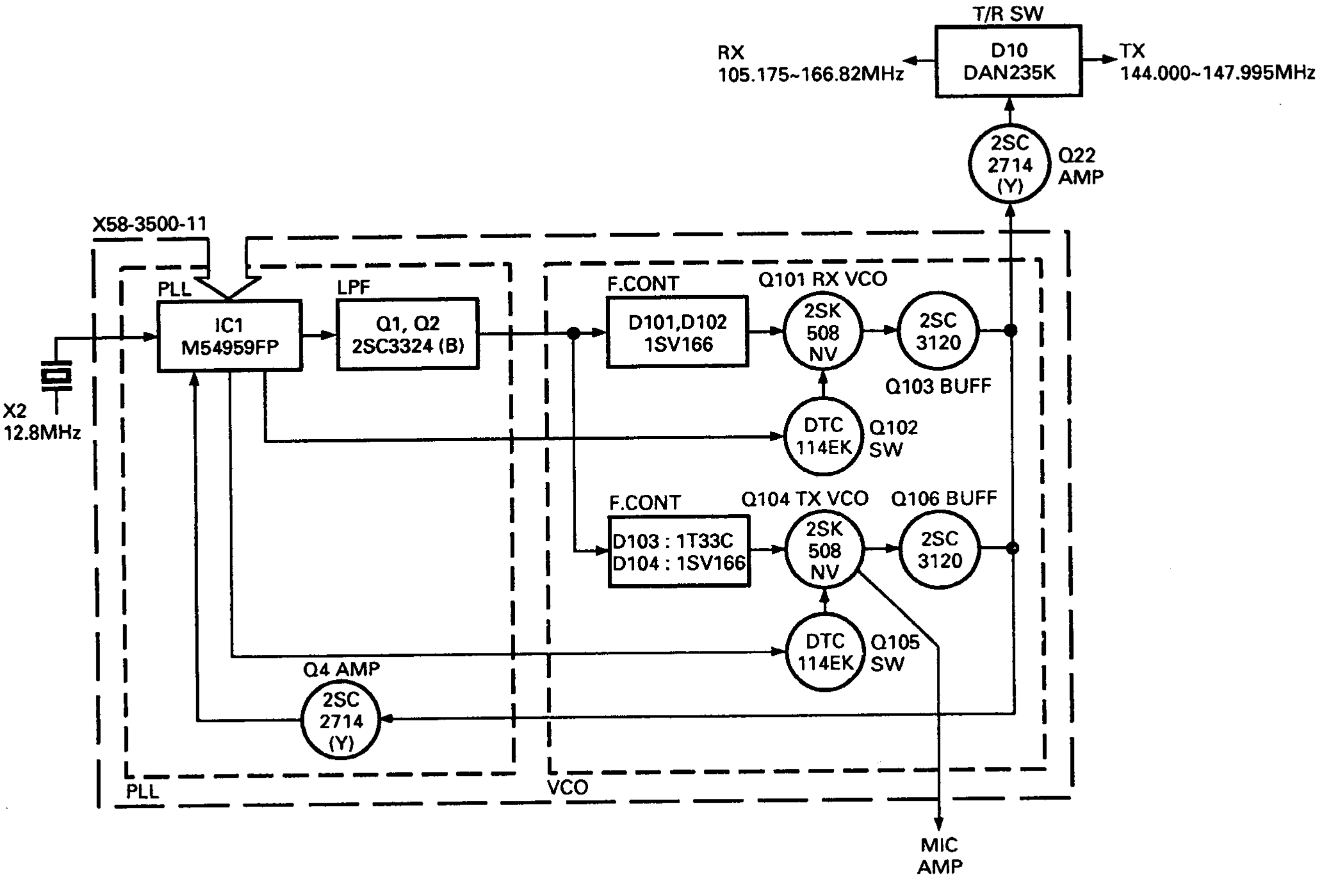

T/R SW
D10
DAN235K
RX
105.175~166.82MHz
TX
144.000~147.995MHz
2SC
2714
(Y)
Q22
AMP
X58-3500-11
PLL
IC1
M54959FP
LPF
Q1, Q2
2SC3324 (B)
F.CONT
D101,D102
1SV166
Q101 RX VCO
2SK
508
NV
2SC
3120
Q103 BUFF
DTC
114EK
Q102
SW
X2
12.8MHz
F.CONT
D103 : 1T33C
D104 : 1SV166
Q104 TX VCO
2SK
508
NV
Q106 BUFF
2SC
3120
DTC
114EK
Q105
SW
Q4 AMP
2SC
2714
(Y)
PLL
VCO
MIC
AMP

Fig. 4-2 PLL block diagram (K2,P2)

CIRCUIT DESCRIPTION

- **8T (8V in transmit mode) and unlock circuits**

In receive mode, the base of Q17 has 0.7V. As a result, Q17 is on, and Q16 and Q14 are off, and the collector of Q14 (8T) provides no voltage.

The CPU outputs serial data to the shift register IC5 when the PTT switch is depressed. As a result, pin 8 of IC5 becomes "L", turning Q17 off, and Q16 and Q14 on. The 8T line is therefore supplied with 8V.

The unlock circuit operates only in transmit mode. Q18 is a PLL unlocking switching transistor. Usually, the base of Q18 is supplied with 0V ("L"), and the collector is supplied with 8V ("H").

When the PLL is unlocked, the base of Q18 is supplied with 0.7V, turning Q18 on. As a result, the collector of Q18 becomes "L" (0V). This turns Q16 off and the collector of Q14 becomes 8V, turning it off. Therefore, when the PLL is unlocked, Q14 is off removing bias voltage from the 8T line. Without the 8T voltage no transmit signal is generated.

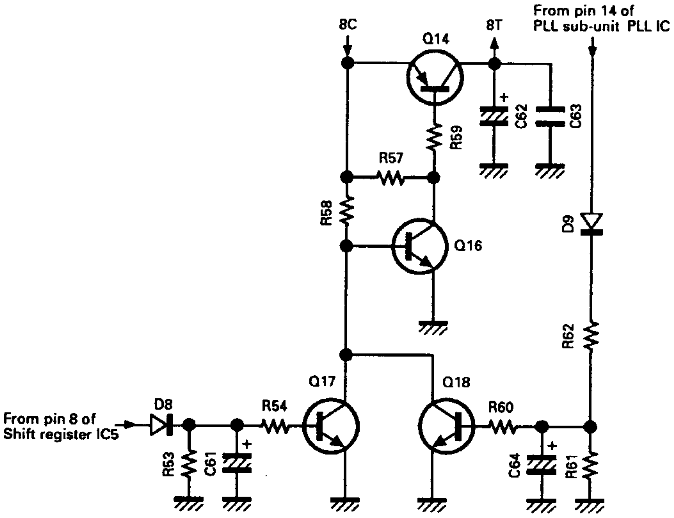

8C
Q14
8T
From pin 14 of PLL sub-unit PLL IC
C62
C63
R59
R57
R58
D9
Q16
R62
Q17
Q18
From pin 8 of Shift register IC5
D8
R54
R60
R53
C61
C64
R61

Fig. 5 8T and unlock circuits

Digital Control Unit

- **Overview**

The digital control unit consists of a several keys, a rotary encoder input, a display, a reset circuit, a back-up circuit, and a tone output circuit. These circuits are controlled by a single microcomputer (CPU).

- **Key and rotary encoder input circuits**

The keys on the panel are arranged in matrix. Key input is fed into the CPU, using a key scan technique. Output from the rotary encoder is fed directly into the CPU.

- **Microphone key input circuit**

The UP, DOWN, and other function keys of the microphone are directly connected to their corresponding analog input pins of the CPU. Each of the functions is activated by a voltage generated when the corresponding key is pressed.

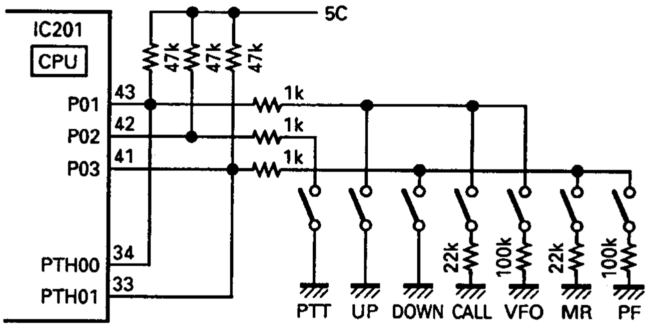

IC201
CPU
5C
47k
47k
47k
P01
P02
P03
43
42
41
1k
1k
1k
PTH00
PTH01
34
33
22k
100k
22k
100k
PTT
UP
DOWN
CALL
VFO
MR
PF

Fig. 6 Microphone key input circuit

- **Reset and back-up circuits**

When the TM-241A/E power is turned on, the reset circuit sends a "L" level pulse to the RESET pin of the CPU for approx. 3ms. This initiates the power-on reset sequence.

When the TM-241A/E power is turned off, the back-up circuit detects a voltage drop in the 5C line and sets CPU INT4 to a "H" level. This causes the CPU to enter a back-up state.

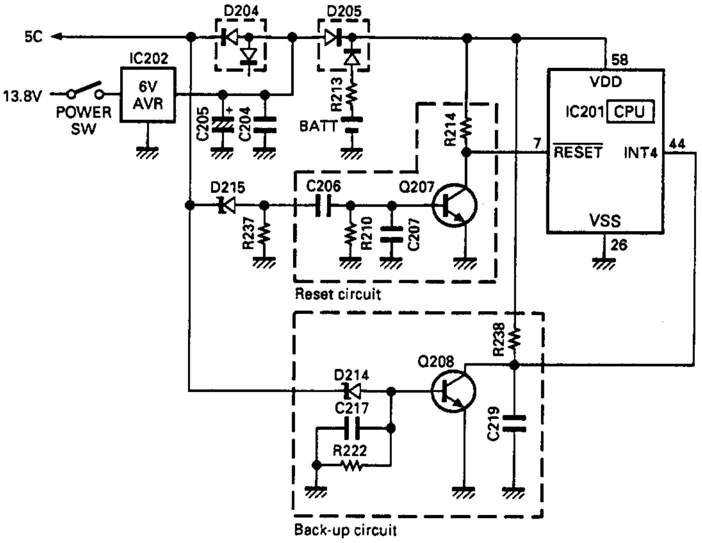

5C
D204
D205
IC202
6V AVR
13.8V
POWER SW
C205
C204
R213
BATT
R214
58
VDD
IC201 CPU
7
RESET
INT4
44
VSS
26
D215
C206
Q207
R237
R210
C207
Reset circuit
R238
Q208
D214
C217
R222
C219
Back-up circuit

Fig. 7 Reset and back-up circuits

CIRCUIT DESCRIPTION

- **Display circuit**

The display circuit is contained in the LCD assembly. It consists of a LCD driver, its peripheral circuits, and an LCD. The LCD is dynamically operated at a 50% duty cycle. The LCD driver receives LCD data from P33, P140, and P141 of the CPU.

- **Dimmer circuit**

The lamp circuit generates a constant voltage of about 8.8V with SB, Q205, and D202. The lamp circuit resistance is changed by turning Q203 and Q204 on and off to control the dimmer. If the lamp is shorted, Q206 decreases the Q205 VBE to prevent an over-current from flowing through Q205.

Brightness	Bright → Dark			
	1	2	3	4
P50	H	L	H	L
P51	H	H	L	L

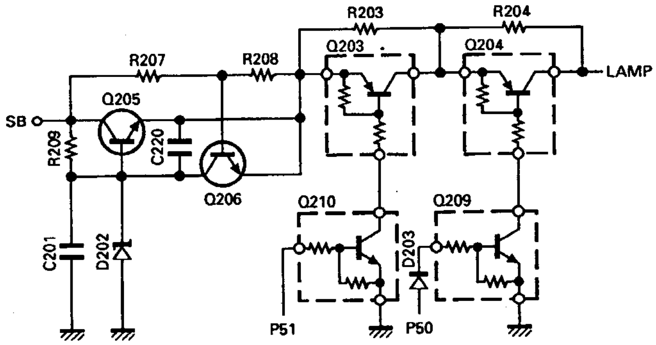


Fig. 8 Dimmer circuit

- **Shift register circuit**

The shift register circuit consists of IC5 (TC9174F). The IC5 receives serial data from the microcomputer to perform the controls listed below.

Pin No.	Pin name	Function
1	GND	
2	B1	Usually "H".
3	B2	Open.
4	CE	Electronic volume select. "H" when electronic volume selected, "L" when panel volume selected or interface connected.
5	VOLD	Electronic volume down. "L" when DOWN key on.
6	VOLU	Electronic volume up. "L" when UP key on.
7	MUTE	AF mute. "H" when TX mode, AL 1ch receive mode, CTCSS, T. ALT, or squelch is on.
8	T/R	Transmit/receive select. "H" in RX mode, "L" in TX mode.
9	TXM	TX power select. "H" in HI or MID mode, "L" in LOW mode.
10	TXH	TX power select. "H" in HI mode, "L" in MID or LOW mode.
11	–	Open.
12	–	Open.
13	DATA	Serial data input.
14	CLOCK	Clock input.
15	EN	Enable input.
16	VDD	

Table 6

- **Tone output circuit**

R246 (ladder resisitor) receives signals from P40 to P43 and P52 to P53 of the CPU and converts them from digital to analog to produce 38 different waveforms from 67.0Hz to 250.3Hz. Figure 9 shows the internal configuration of R246.

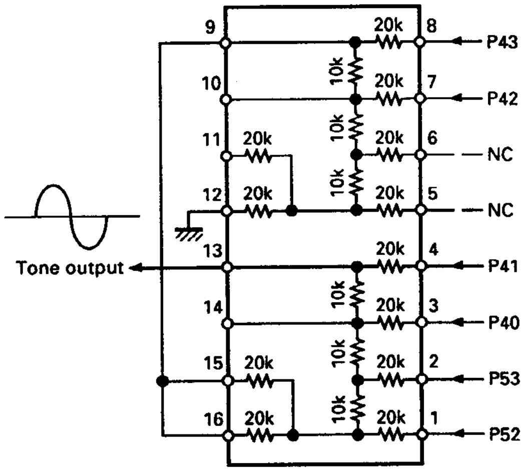


Fig. 9 Internal configuration of ladder resistor (TX-RX unit B/2 R246)

CIRCUIT DESCRIPTION

- **PLL data output**

PLL data is available from P21 (CK), P22 (DT), and P23 (EP1) of the CPU. Figure 10 is a timing chart for PLL data transfer, and Figure 11 shows the format of PLL data.

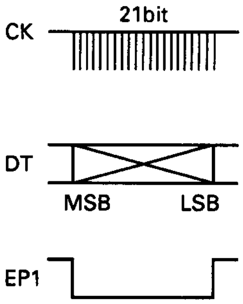
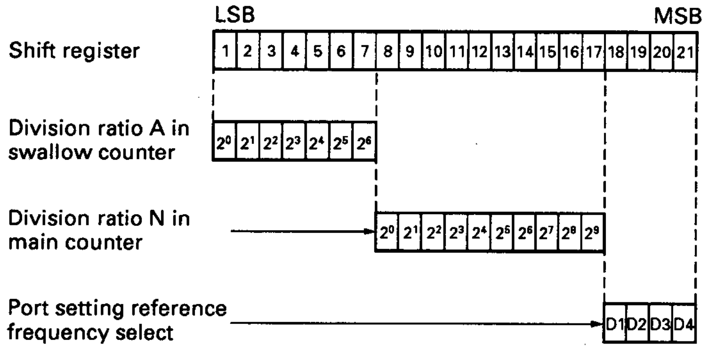

21bit
CK
DT
MSB
LSB
EP1

Fig. 10 Timing chart for PLL data transfer


LSB
MSB
Shift register
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Division ratio A in swallow counter
2^0 2^1 2^2 2^3 2^4 2^5 2^6
Division ratio N in main counter
2^0 2^1 2^2 2^3 2^4 2^5 2^6 2^7 2^8 2^9
Port setting reference frequency select
D1 D2 D3 D4

The 21-bit data is made up of the following;

1. Division ratio data A and N (17 bits)

F (display − 10.7MHz or 30.825MHz in RX mode)
$=\{(N \times 128) + A\} \times 12.8\text{MHz} \div \text{ref}$
N : Division ratio set in 10-bit main counter (binary)
A : Division ratio set in 7-bit swallow counter (binary)

2. Reference frequency (ref) select (2 bits)

Data		Phase reference frequency	
D1	D2		
L	L	5kHz	5, 10, 15, 20, 25kHz step mode
H	L	6.25kHz	12.5kHz step mode

3. Switch select (2 bits)

Data		Output port		
D3	D4	SW1	SW2	
L	H	L	H	RX mode
H	L	H	L	TX mode

Fig. 11 PLL data format

- **Input and output of CTCSS unit (option)**

The optional CTCSS unit receives data from P21, P22, and P73 of the CPU. Figure 12 is a timing chart for CTCSS data transfer, and Figure 13 shows the format of CTCSS data. When a tone form the CTCSS unit is detected, a "H" level signal is sent to TIO of the CPU, opening the squelch.

- **Input and output of the remote control unit (option)**

When the optional remote control unit is connected, a "H" level signal is applied to INT0 of the CPU, and the following pins have different functions;

P03 → S1 : Serial data input pin
P02 → S2 : Serial data output pin
P01 → SCK : Serial clock I/O pin

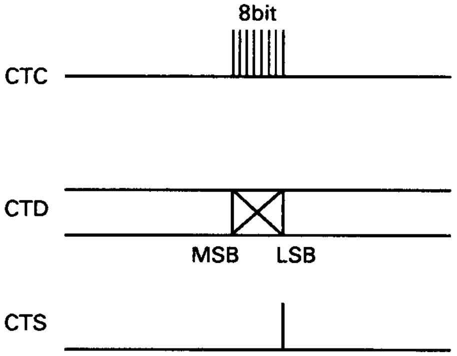

8bit
CTC
CTD
MSB
LSB
CTS

Fig. 12 Timing chart for CTCSS data transfer

Tone frequency select data for CTCSS unit

	D1	D2	D3	D4	D5	D6
Example : 88.5Hz	L	H	L	H	H	H

Fig. 13 CTCSS data format

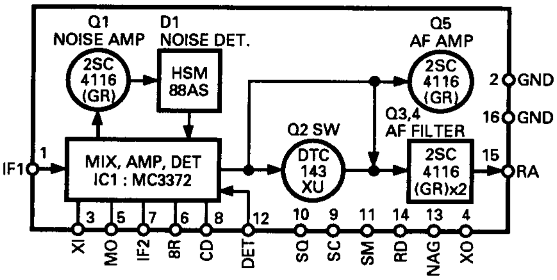
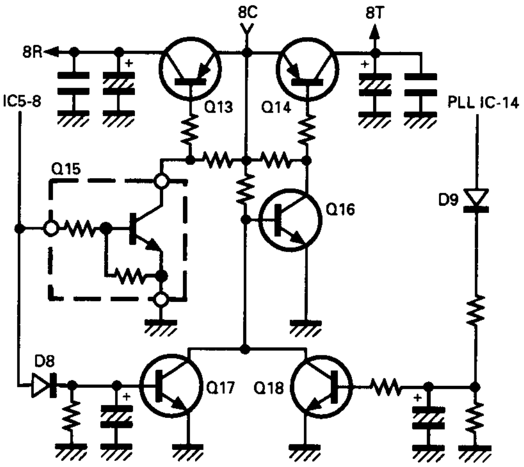
CIRCUIT DESCRIPTION

Pin No.	Pin name	I/O	Logic	Function
1, 2	P41, P40	O	–	D/A digital output (tone).
3, 4	P53, P52	O	–	D/A digital output (tone).
5, 6	P51, P50	O	–	Dimmer select.
7	$\overline{\text{RESET}}$	I	L	Reset input.
8, 9	X2, X1	–	–	4.194304MHz crystal oscillator.
10	P63	I	H	Function display.
11	P62	O	H	DRS remote control ST.
12	P61	O	–	DRS unit reset $\overline{\text{ACL}}$.
13	P60	I	H	DTMF signal detect.
14	P73	O	H	CTCSS unit enable output.
15	P72	O	H	Shift register enable output.
16	P71	O	H	DRS unit VOB output.
17	P70	O	H	DRS unit VOA output.
18	P83	O	H	DRS unit OE, DTSS EN output.
19	P82	O	H	DRS unit STBY output.
20	P81	O	L	DTSS DTSEL output, DRS unit $\overline{\text{WR}}$ output.
21	P80	O	L	DRS unit $\overline{\text{RD}}$ output.
22~25	P93~P90	O	H	DRS unit data output. D8/D3, D4/D2, D2/D1, D1/D0
26	Vss	–	–	GND.
27	P13	I	H	DRS unit connect check.
28, 29	INT2, INT1	I	–	Encoder input.
30	P10	I	H	Remote connect detect input.
31	PTH03	I	–	S-meter analog input.
32	PTH02	I	–	Not used (GND).
33	PTH01	I	–	Microphone DOWN/MR/PF input.
34	PTH00	I	–	Microphone UP/CALL/VFO input.
35	TI0	I	H	CTCSS unit DET input.
36	TI1	I	L	Not used (GND).
37	P23	O	L	PLL IC enable output.
38	P22	O	–	Serial data output.
39	P21	O	–	Serial clock output.
40	P20	O	–	Beeper output.
41	P03/SI	I/I	L/–	Serial data input. (KENWOOD BUS)
42	P02/SO	I/O	L/–	Serial data output. (KENWOOD BUS)
43	P01/$\overline{\text{SCK}}$	I/–	L/–	Serial clock I/O. (KENWOOD BUS).
44	INT4	I	H	Back-up detect input. Back-up : "H"
45	P123	I	L	CALL, VFO key and destination input.
46	P122	I	L	F, MR/M key and destination input.
47	P121	I	L	SHIFT, MHz key and destination input.
48	P120	I	L	TONE key and destination input.
49	P133	I	L	REV key and destination input.
50	P132	I	L	LOW, DRS/DTSS key and destination input.
51	P131	I	L	Not used (GND).
52	P130	I	L	Busy input.
53	P143	O	L	Squelch control.
54	P142	O	H	Power switch.
55	P141	O	–	LCD driver clock output.
56	P140	O	–	LCD driver data output.
57	NC	–	–	Not used (VDD).
58	VDD	–	–	Power supply pin.
59	P33	O	–	LCD driver enable output.
60	P32	O	L	Destination output.
61, 62	P31, P30	O	L	Key output.
63, 64	P43, P42	O	–	D/A digital output (tone).

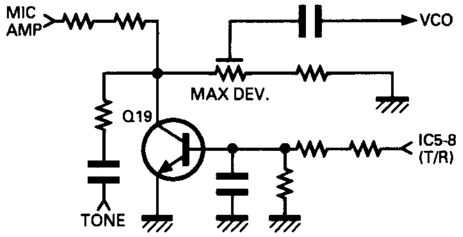
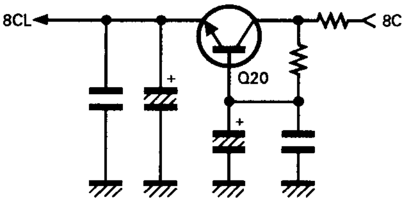
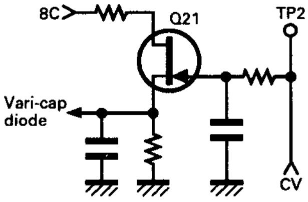
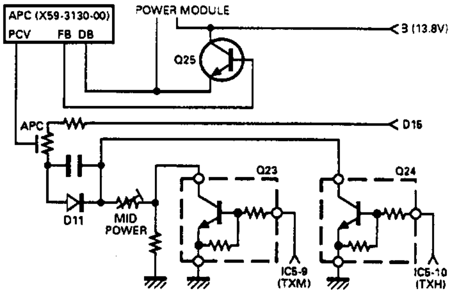
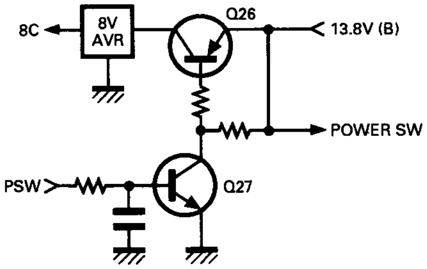
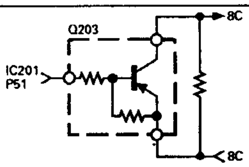
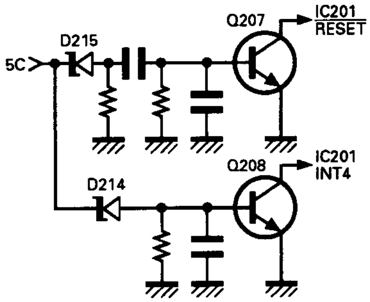
Table 7 CPU : 75116GF-XXX-3BE terminal functions (TX-RX unit IC201)

DESCRIPTION OF COMPONENTS

TX-RX UNIT (X57-369X-XX) 0-11 : K,P,X 0-12 : K2,P2 0-21 : M 0-22 : M2,M3 2-71 : E,E9,EM 2-72 : E2

Ref. No	Use/Function	Operation/Condition compatibility
IC1	2nd local oscillator, IF amplification, Detection, Low-frequency amplification, Noise amplification, Noise detection, Squelch switching	1 : 1st If signal input. 3, 4 : 2nd local oscillator. 9 : Busy output. 10 : Squelch control. 11 : S-meter output. 14 : RD output. 15 : Low-frequency output.  Q1 NOISE AMP 2SC 4116 (GR) D1 NOISE DET. HSM 88AS Q5 AF AMP 2SC 4116 (GR) 2 GND 16 GND Q3,4 AF FILTER 2SC 4116 (GR)x2 Q2 SW DTC 143 XU IF1 1 MIX, AMP, DET IC1 : MC3372 15 RA 3 5 7 6 8 12 10 9 11 14 13 4 XI MO IF2 8R CD DET SQ SC SM RD NAG XO
IC2	AM detector	
IC3	AF amplification	1 : AF input 6 : AF output
IC4	Electronic volume conntrol, AF switch	2 : AF output. 3 : "L" during step-up. 4 : "L" during step-down. 5 : "H" when electronic volume selected. 7 : Panel volume input. 8 : Panel volume output. 10 : AF input.
IC5	Shift register	See circuit description.
IC6	5V AVR	
IC7	10V AVR	For PLL.
IC8	Transmit drive	
IC9	8V AVR	
IC201	Microprocessor	See circuit description.
IC202	6V AVR	
Q1	High-frequency amplification	Operates in receive mode.
Q2	11R switching	On when the aircraft band is selected.
Q3	BPF switching	On when the aircraft band is selected.
Q4	1st mixer	Converts received 144MHz-range signals to 1st IF.
Q5	High-frequency amplification	Amplifies 1st IF signal.
Q6	Q5 gain control	
Q7	Detector output switch	When the aircraft band is selected, the FM detection switch is turned off.
Q8	AF amplifier	When the aircraft band is selected, the output signal from the AM detector is amplified.
Q9 (1/2)	RD line mute	On when DRS unit replays.
Q9 (2/2)	AF line mute	
Q10	Low-frequency amplification	Operates when DRS unit replays.
Q12	AF line mute	Operates when transmit mode, AL 1ch receive mode, CTCSS, T. ALT or squelch is on.
Q13	8R switching	On in receive mode.  8C 8T 8R IC5-8 Q13 Q14 PLL IC-14 Q15 Q16 D9 D8 Q17 Q18
Q14	8T switching	On in transmit mode.
Q15	8R switching control	On in receive mode.
Q16	8T switching control	On in transmit mode.
Q17	8T switching control	Off in transmit mode.
Q18	8T switching control	Off when PLL locked.

DESCRIPTION OF COMPONENTS

Ref. No	Use/Function	Operation/Condition compatibility
Q19	Mic line mute	On in receive mode.  MIC AMP VCO MAX DEV. Q19 IC5-8 (T/R) TONE
Q20	PLL 8V ripple filter	
Q21	CV line buffer	 8C Q21 TP2 Vari-cap diode CV
Q22	VCO output amplification	
Q23	TX power select	On in HI or MID mode.  APC (X59-3130-00) PCV FB DB POWER MODULE B (13.8V) Q25 APC D15 Q23 Q24 D11 MID POWER IC5-9 (TXM) IC5-10 (TXH)
Q24	TX power select	On in HI mode.
Q25	TX drive stage +B control	
Q26	Power switch	 8C 8V AVR Q26 13.8V (B) POWER SW PSW Q27
Q27	Power switch control	On when power switch is on.
Q28	Squelch hysteresis	On when the squelch is on.
Q201, 202	Function dimmer switch	Refer to circuit description.
Q203, 204	Lamp dimmer switch	 Q203 8C IC201 P51 8C
Q205	Lamp AVR	
Q206	Lamp AVR	
Q207	Reset switch	On for approx. 3ms when system power turned on. Usually off.  Q207 IC201 RESET D215 5C Q208 IC201 INT4 D214
Q208	Back-up switch	Off when 13.8V line becomes 7.5V or less. Usually on.

DESCRIPTION OF COMPONENTS

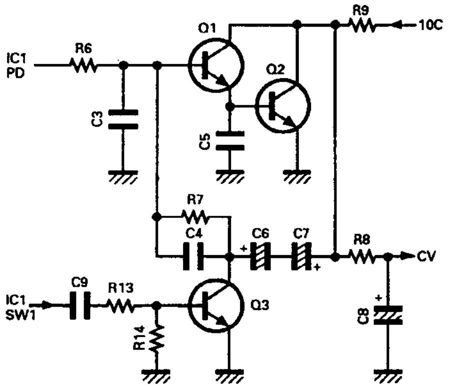
<table>
<tr><th>Ref. No</th><th>Use/Function</th><th>Operation/Condition compatibility</th></tr>
<tr><td>Q209, 210</td><td>Dimmer switch on/off</td><td>Turn Q201~Q204 on or off.
<table>
<tr><td>Dimmer</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Q209</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr>
<tr><td>Q210</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
</table></td></tr>
<tr><td>Q211</td><td>Function drive switch</td><td></td></tr>
<tr><td>Q212</td><td>Mic mute</td><td>On when DTSS and paging codes are sent.</td></tr>
<tr><td>D1</td><td>Band select switch (AM/FM)</td><td>On when the aircraft band is selected.</td></tr>
<tr><td>D2~6</td><td>Vari-cap tuning</td><td></td></tr>
<tr><td>D7~9</td><td>Reverse current prevention</td><td></td></tr>
<tr><td>D10</td><td>VCO output switch</td><td></td></tr>
<tr><td>D11</td><td>Temperature compensation</td><td>For APC.</td></tr>
<tr><td>D12, 13</td><td>Transmit/receive switching</td><td></td></tr>
<tr><td>D14, 15</td><td>Power detection</td><td>For APC.</td></tr>
<tr><td>D16</td><td>Reverse power protection</td><td></td></tr>
<tr><td>D202</td><td>Lamp standard voltage</td><td></td></tr>
<tr><td>D203</td><td>Dimmer switch</td><td></td></tr>
<tr><td>D204, 205</td><td>Switch</td><td>D205 switches in the lithium battery when the power is off.</td></tr>
<tr><td>D206~211</td><td>Used for destination setting</td><td></td></tr>
<tr><td>D212</td><td>CPU protector</td><td></td></tr>
<tr><td>D213</td><td>Reverse current prevention</td><td></td></tr>
<tr><td>D214</td><td>Back-up detection voltage</td><td></td></tr>
<tr><td>D215</td><td>Reset detection voltage</td><td></td></tr>
<tr><td>D216</td><td>Function LED</td><td></td></tr>
<tr><td>D217</td><td>Reverse current prevention</td><td></td></tr>
</table>

PLL (X58-3470-00) : K,P,M,M2,M3,X,E,E2,E9,EM

Ref. No	Use/Function	Operation/Condition compatibility
IC51	PLL	1 : VCO input. 133.300 to 135.295MHz (E,E9,EM), 133.300 to 137.295MHz (M), 125.300 to 163.295MHz (K,P,X,M2,M3,E2) in receive mode, 144.000 to 145.995MHz (E,E9,EM), 144.000 to 147.995MHz (K,P,X,M), 136.000 to 173.995MHz (M2,M3,E2) in transmit mode. 11 : "L" in transmit mode 14 : "H" when PLL unlocked
Q51	VCO output buffer	
Q52	Transmit switch	Off in transmit mode.
Q53	Transmit switch	On for moment when transmission starts.
Q101, 102	LPF	
Q1	VCO output buffer	
Q2	VCO	133.300 to 135.295MHz (E,E9,EM), 133.300 to 137.295MHz (M), 125.300 to 163.295MHz (K,P,X,M2,M3,E2) in receive mode, 144.000 to 145.995MHz (E,E9,EM), 144.000 to 147.995MHz (K,P,X,M), 136.000 to 173.995MHz (M2,M3,E2) in transmit mode.
D1	For modulation in TX mode	
D2	VCO voltage control	

DESCRIPTION OF COMPONENTS

PLL (X58-3500-11) : K2,P2

Ref. No	Use/Function	Operation/Condition compatibility
IC1	PLL	1 : VCO input. 105.175 to 166.820MHz in receive mode, 144.000 to 147.995MHz in transmit mode. 10,11 : "H" in transmit mode 13 : Phase comparison output 14 : "H" when PLL unlocked 23 : Reference oscillation input
Q1, 2	LPF	 IC1 PD R6 C3 Q1 Q2 C5 R9 10C R7 C4 C6 C7 R8 CV IC1 SW1 C9 R13 R14 Q3 C8
Q3	Transmit switch	On for an instant when transmission starts.
Q4	VCO output amplification	105.175 to 166.820MHz in receive mode, 144.000 to 147.995MHz in transmit mode.
Q101	Receive VCO	105.175 to 166.820MHz.
Q102	Receive VCO switch	On in receive mode.
Q103	Receive VCO output buffer	105.175 to 166.820MHz.
Q104	Transmit VCO	144.000 to 147.995MHz.
Q105	Transmit VCO switch	On in transmit mode.
Q106	Transmit VCO output buffer	144.000 to 147.995MHz.
D101, 102	VCO voltage control	Receive.
D103	VCO voltage control/ Varactor diode for modulation in transmit mode	
D104	VCO voltage control	Transmission.

APC (X59-3130-00)

Ref. No	Use/Function	Operation/Condition compatibility
Q1	Differential amplification	
Q2 (2/2)	APC control	
Q3	Drive stage +B AVR	

MIC AMP (X59-3610-00)

Ref. No	Use/Function	Operation/Condition compatibility
IC1 (1/2)	Limited amplification	
IC1 (2/2)	LPF	
Q1	Low-frequency amplification	

PARTS LIST

⁎ New Parts

Parts without **Parts No.** are not supplied.

Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.

Teile ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
TM-241A/E						
1	1B		A01-1065-03	METALLIC CABINET(TOP)		
2	2B		A01-1066-03	METALLIC CABINET(BOTTOM)		
3	1C		A10-1292-01	CHASSIS CALKED ASSY		
4	2B		A22-0770-13	SUB PANEL		
5	2A	*	A62-0007-33	PANEL ASSY	KMM2PX	
5	2A	*	A62-0007-33	PANEL ASSY	M3K2P2	
5	2A	*	A62-0008-33	PANEL ASSY	EE2	
5	2A	*	A62-0008-33	PANEL ASSY	EM,E9	
			B42-3343-04	S/NO LABEL(NAME PLATE)		
			B42-3356-04	LABEL(EXT SP)		
9	1B		B42-3394-14	FCC LABEL	KK2	
10	3E		B42-5526-04	LABEL	KK2	
11	1C		B72-0093-04	MODEL NAME PLATE	KPX	
11	1C		B72-0093-04	MODEL NAME PLATE	K2P2	
11	1C		B72-0094-04	MODEL NAME PLATE	MM2M3	
11	1C		B72-0095-14	MODEL NAME PLATE	EE2E9	
11	1C	*	B72-0432-04	MODEL NAME PLATE	EM	
11	1C	*	B72-0651-14	MODEL NAME PLATE	E9	
12	2B		B11-0484-08	FILTER(LCD)		
13	2B		B30-0869-05	LAMP		
14	2B		B38-0330-05	LCD ASSY		
15	1B,1C		B42-2455-04	LABEL(M4X8 MAX)		
16	1D		B46-0310-03	WARRANTY CARD	EE9E2	
16	2E		B46-0410-30	WARRANTY CARD	KK2	
16	1D		B46-0422-00	WARRANTY CARD	PP2	
17	1E		B62-0031-10	INSTRUCTION MANUAL	KXK2	
17	1D		B62-0032-10	INSTRUCTION MANUAL	MM2PM3	
17	1D		B62-0032-10	INSTRUCTION MANUAL	EE2E9	
17	1D		B62-0032-10	INSTRUCTION MANUAL	P2	
17	1E		B62-0440-00	INSTRUCTION MANUAL	EM	
18	1D		B62-0033-00	INSTRUCTION MANUAL	EE2E9	
			E31-3197-15	CONNECTING WIRE(SP)		
			E37-0051-05	WIRE (POWER HIGH LOW)	EM	
20	2D		E30-2111-05	DC CABLE		
21	1C		E30-2137-15	DC CABLE		
22	1C		E30-2145-15	ANT CABLE		
		*	F15-0677-04	SHADE		
25	2D		F51-0017-05	FUSE 15A		
26	1C		F51-0018-05	FUSE 20A		
27	1B		F20-0587-04	INSULATING BOARD(LITHIUM BATT)		
28	1B		F20-1059-04	INSULATING BOARD(LITHIUM BATT)		
			G02-0558-04	FLAT SPRING (TX-RX B PATTERN)		
30	2C		G02-0565-04	FLAT SPRING (COIL)	KPX	
30	2C		G02-0565-04	FLAT SPRING (COIL)	K2P2	
			G13-0926-04	CUSHION (CONT)		
32	1B,1C		G02-0576-14	FLAT SPRING		
33	2A		G09-0405-05	SPRING (KNOB)		
			G10-0651-04	NON-WOVEN FABRIC(SP)		
35	1B,2C		G10-0681-04	NON-WOVEN FABRIC(CHASSIS)		
36	1B,2C		G10-0686-04	NON-WOVEN FABRIC(CASE)		
		*	G10-0747-04	NON-WOVEN FABRIC(LCDASSY)	K2P2	
		*	G13-0959-04	CUSHION (TX-RX)	K2P2	

L:Scandinavia **K**:USA **P**:Canada

Y:PX(Far East, Hawaii) **T**:England **E**:Europe

Y:AAFES(Europe) **X**:Australia **M**:Other Areas

TM-241A : (K,P,X,M,M2,M3,K2,P2)

TM-241E : (E,E2,E9,EM)

⚠ indicates safety critical components.

PARTS LIST

⁎ New Parts
Parts without **Parts No.** are not supplied.
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Teile ohne **Parts No.** werden nicht geliefert.

TM-241A/E

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
39	2B		G13-0906-04	CUSHION (3KEY)		
40	2A		G13-0960-04	CUSHION (6KEY)		
41	2B		G13-0961-04	CUSHION (LOW)		
43	3E		H10-2658-02	POLYSTYRENE FOAMED FIXTURE		
44	1E		H11-0822-04	POLYSTYRENE PLATE	KXK2EM	
45	1D		H11-0823-04	POLYSTYRENE PLATE	MM2P	
45	1D		H11-0823-04	POLYSTYRENE PLATE	M3P2	
46	2E		H13-0814-04	PROTECTION PLATE		
47	1D		H13-0825-04	PROTECTION SHEET	MM2PM3	
47	1D		H13-0825-04	PROTECTION SHEET	P2	
47	1D		H13-0825-04	PROTECTION SHEET	EE2E9	
48	2D		H25-0029-04	PROTECTION BAG(MIC HOOK)	KPK2P2	
49	2D		H25-0117-04	PROTECTION BAG(DC CABLE)		
50	2E		H25-0720-04	PROTECTION BAG(RADIO)		
			H25-0750-04	PROTECTION BAG	EE2E9	
51	3D		H52-0054-04	ITEM CARTON BOX	KMM2PX	
51	3D		H52-0054-04	ITEM CARTON BOX	M3K2P2	
51	3D		H52-0055-04	ITEM CARTON BOX	EE2E9	
51	3D	*	H52-0301-04	ITEM CARTON BOX	EM	
53	1C		J19-1434-04	HOLDER(SP)		
54	2D		J20-0319-24	MIC HOOK	KPK2P2	
55	2A		J21-4303-08	MOUNTING HARDWARE(LCD ASSY)		
56	2E		J29-0436-03	BRACKET		
58	2B		K27-3035-14	KNOB(ENCODER)		
59	2B		K27-3066-04	KNOB(POWER SW)		
60	2B		K27-3067-04	KNOB(LOW)		
61	2A		K27-3068-14	KNOB(CALL)		
62	2A		K27-3069-14	KNOB(FUNC)		
63	2A		K27-3071-14	KNOB(TONE)		
64	2A		K27-3072-14	KNOB(REVERSE)		
65	2A		K27-3074-14	KNOB(SHIFT)		
66	2A		K27-3075-14	KNOB(DR/DT)		
67	2A		K29-3156-04	KNOB(MAIN)		
68	2A		K29-3157-04	KNOB(VOL,SQL)		
70	2D		N99-0331-05	SCREW SET		
71	2D		N46-3010-46	PAN HEAD TAPPING SCREW	KPK2P2	
A	2B	*	N67-3010-41	SCREW(POWER MODULE 3X10)		
B	2B		N38-2640-46	SCREW(SUB PANEL)		
C	1C,2C		N33-2606-45	OVAL HEAD MACHINE SCREW(CASE)		
D	1C,2C		N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
E	2B		N87-2610-46	BRAZIER HEAD TAPTITE SCREW		
F	2B		N88-2606-46	FLAT HEAD TAPTITE SCREW		
73	2E		T91-0379-35	MICROPHONE	MM2X	
73	2E		T91-0380-45	MICROPHONE(DTMF)	KPM3	
73	2E		T91-0380-45	MICROPHONE(DTMF)	K2P2	
73	2E	*	T91-0382-35	MICROPHONE(1750Hz TONE)	EE2	
73	2E	*	T91-0382-35	MICROPHONE(1750Hz TONE)	EM,E9	
SP	1C		T07-0246-05	LOUDSPEAKER		
IC1			LC7582	IC(LCD DRIVER)		
IC301	2C		S-AV17	IC(POWER MODULE FOR 144MHZ)		
75	2D		W01-0414-04	WRENCH		
76	2B		W09-0326-05	LITHIUM BATTERY		

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TM-241A/E
TX-RX UNIT (X57-369X-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti- nation 仕向	Re- marks 備考
77	2B,2C		X57-3690-11	TX・RX UNIT	KPX	
77	2B,2C	*	X57-3690-12	TX・RX UNIT	K2P2	
77	2B,2C		X57-3690-21	TX・RX UNIT	M	
77	2B,2C		X57-3690-22	TX・RX UNIT	M2M3	
77	2B,2C		X57-3692-71	TX・RX UNIT	EE9,EM	
77	2B,2C		X57-3692-72	TX・RX UNIT	E2	
TX-RX UNIT (X57-369X-XX) 0-11 : (K,P,X) 0-12 : (K2,P2) 0-21 : (M) 0-22 : (M2,M3) 2-71 : (E,E9,EM) 2-72 : (E2)						
C1			CC73FCH1H040C	CHIP C 4PF C		
C2			CC73FCH1H060D	CHIP C 6PF D	KPX	
C2			CC73FCH1H050C	CHIP C 5PF D	K2P2	
C3			CC73FCH1H040C	CHIP C 4PF C	KPX	
C3			CC73FCH1H040C	CHIP C 4PF C	K2P2	
C3			CC73FCH1H070D	CHIP C 7PF D	MM2M3E	
C3			CC73FCH1H070D	CHIP C 7PF D	E2E9EM	
C4 ,5			CK73FB1H102K	CHIP C 1000PF K	KPX	
C4 ,5			CK73FB1H102K	CHIP C 1000PF K	K2P2	
C6 ,7			CK73FB1H102K	CHIP C 1000PF K		
C8			CK73FB1H103K	CHIP C 0.010UF K		
C9			CK73FB1H102K	CHIP C 1000PF K		
C10			CC73FCH1H0R5C	CHIP C 0.5PF C		
C11			CC73FCH1H470J	CHIP C 47PF J	KPXMM2	
C11			CC73FCH1H470J	CHIP C 47PF J	M3EE9	
C11			CC73FCH1H470J	CHIP C 47PF J	EM,E2	
C11			CC73FCH1H680J	CHIP C 68PF J	K2P2	
C12			CK73FB1H103K	CHIP C 0.010UF K		
C13			CC73FCH1H0R5C	CHIP C 0.5PF C		
C14			CC73FCH1H470J	CHIP C 47PF J	KPXMM2	
C14			CC73FCH1H470J	CHIP C 47PF J	M3EE9	
C14			CC73FCH1H470J	CHIP C 47PF J	EM,E2	
C14			CC73FCH1H680J	CHIP C 68PF J	K2P2	
C15			CK73FB1H102K	CHIP C 1000PF K		
C16			CC73FCH1H150J	CHIP C 15PF J		
C17			CC73FCH1H470J	CHIP C 47PF J	KPXMM2	
C17			CC73FCH1H470J	CHIP C 47PF J	M3EE9	
C17			CC73FCH1H470J	CHIP C 47PF J	EM,E2	
C17			CC73FCH1H680J	CHIP C 68PF J	K2P2	
C18			CK73FB1H103K	CHIP C 0.010UF K		
C19			CC73FCH1H030C	CHIP C 3PF C		
C20			CK73FB1H102K	CHIP C 1000PF K		
C21			CK73FB1H103K	CHIP C 0.010UF K		
C22			CK73FB1H102K	CHIP C 1000PF K		
C23			CC73FCH1H050C	CHIP C 5PF C	KPXMM2	
C23			CC73FCH1H050C	CHIP C 5PF C	M3EE9	
C23			CC73FCH1H050C	CHIP C 5PF C	EM,E2	
C23			CC73FCH1H080D	CHIP C 8PF D	K2P2	
C24			CK73FB1H102K	CHIP C 1000PF K		
C25			CK73FB1H103K	CHIP C 0.010UF K		
C26			CC73FCH1H220J	CHIP C 22PF J	KPXMM2	
C26			CC73FCH1H220J	CHIP C 22PF J	M3EE9	
C26			CC73FCH1H220J	CHIP C 22PF J	EM,E2	
C27			CK73FB1H102K	CHIP C 1000PF K		
C28			CC73FCH1H330J	CHIP C 33PF J	KPXMM2	
C28			CC73FCH1H330J	CHIP C 33PF J	M3EE9	
C28			CC73FCH1H330J	CHIP C 33PF J	EM,E2	

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TX-RX UNIT (X57-369X-XX)

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C28			CC73FCH1H100D	CHIP C 10PF D	K2P2	
C29			CC73FCH1H151J	CHIP C 150PF J	KPXMM2	
C29			CC73FCH1H151J	CHIP C 150PF J	M3EE9	
C29			CC73FCH1H151J	CHIP C 150PF J	EM,E2	
C29			CK73FB1H102K	CHIP C 1000PF K	K2P2	
C30			CK73FB1H102K	CHIP C 1000PF K	KPX	
C30			CK73FB1H102K	CHIP C 1000PF K	K2P2	
C31			CC73FSL1H101J	CHIP C 100PF J	KPX	
C31			CC73FSL1H101J	CHIP C 100PF J	K2P2	
C32			CK73EF1C105Z	CHIP C 1.0UF Z	KPX	
C32			CK73EF1C105Z	CHIP C 1.0UF Z	K2P2	
C33			CK73FB1H223K	CHIP C 0.022UF K	KPX	
C33			CK73FB1H223K	CHIP C 0.022UF K	K2P2	
C34			CK73FB1H333K	CHIP C 0.033UF K	KPX	
C34			CK73FB1H333K	CHIP C 0.033UF K	K2P2	
C35			C92-0004-05	ELECTRO 1.0UF 16WV	KPX	
C35			C92-0004-05	ELECTRO 1.0UF 16WV	K2P2	
C36 ,37			CK73FB1H103K	CHIP C 0.010UF K	KPX	
C36 ,37			CK73FB1H103K	CHIP C 0.010UF K	K2P2	
C38			C92-0002-05	CHIP TAN 0.22UF 35WV	K2P2	
C38			C92-0504-05	CHIP TAN 0.68UF 20WV	KPXMM2	
C38			C92-0504-05	CHIP TAN 0.68UF 20WV	M3EE9	
C38			C92-0504-05	CHIP TAN 0.68UF 20WV	EM,E2	
C39 -41			CK73EF1C105Z	CHIP C 1.0UF Z		
C43			CE04EW1A470M	ELECTRO 47UF 10WV		
C44			CK73FB1H103K	CHIP C 0.010UF K		
C47			CK73EB1H104K	CHIP C 0.10UF K		
C48			CE04EW1A471M	ELECTRO 470UF 10WV		
C49			CK73FB1H103K	CHIP C 0.010UF K		
C50			CE04EW1C470M	ELECTRO 47UF 16WV		
C51 -53			CE04EW1A470M	ELECTRO 47UF 10WV		
C54			CK73FB1H273K	CHIP C 0.027UF K		
C55			CC73FSL1H101J	CHIP C 100PF J		
C56			CE04EW1E4R7M	ELECTRO 4.7UF 25WV		
C57 ,58			CK73EF1C105Z	CHIP C 1.0UF Z		
C59			CK73FB1H103K	CHIP C 0.010UF K		
C60			CE04EW1A470M	ELECTRO 47UF 10WV		
C61			C92-0504-05	CHIP TAN 0.68UF 20WV		
C62			CE04EW1A470M	ELECTRO 47UF 10WV		
C63			CK73FB1H103K	CHIP C 0.010UF K		
C64			C92-0504-05	CHIP TAN 0.68UF 20WV		
C65 ,66			CK73FB1H102K	CHIP C 1000PF K		
C67			CC73FCH1H050C	CHIP C 5PF C		
C68			C92-0501-05	CHIP-TAN 1.5UF 6.3WV		
C69			CK73FB1H103K	CHIP C 0.010UF K		
C70			CC73FCH1H390J	CHIP C 39PF J	K2P2	
C71			CK73FB1H102K	CHIP C 1000PF K		
C72			CK73EB1H473K	CHIP C 0.047UF K		
C73			CK73FB1H102K	CHIP C 1000PF K		
C74			CK73EF1C105Z	CHIP C 1.0UF Z		
C75 ,76			CK73FB1H102K	CHIP C 1000PF K		
C78			CK73FB1H102K	CHIP C 1000PF K		
C79			CC73FCH1H330J	CHIP C 33PF J		
C80			CK73FB1H102K	CHIP C 1000PF K		
C81			CC73FCH1H220J	CHIP C 22PF J		

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TX-RX UNIT (X57-369X-XX)

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C82			CK73FB1H103K	CHIP C 0.010UF K		
C83			CE04EW1A470M	ELECTRO 47UF 10WV		
C84			CK73FB1H103K	CHIP C 0.010UF K		
C85			CE04EW1A221M	ELECTRO 220UF 10WV		
C86			CE04EW1C100M	ELECTRO 10UF 16WV		
C87 ,88			CK73FB1H103K	CHIP C 0.010UF K		
C89 -92			CK73FB1H102K	CHIP C 1000PF K		
C93			CK73FB1H103K	CHIP C 0.010UF K		
C94			CE04EW1A470M	ELECTRO 47UF 10WV		
C95 ,96			CK73FB1H103K	CHIP C 0.010UF K		
C97			CE04EW1C102M	ELECTRO 1000UF 16WV		
C99			CK73FB1H102K	CHIP C 1000PF K		
C100			CK73EF1C105Z	CHIP C 1.0UF Z		
C101			CK73FB1H102K	CHIP C 1000PF K		
C102			CE04EW1C100M	ELECTRO 10UF 16WV		
C104			CC45SL2H220J	CERAMIC 22PF J		
C105			CK73FB1H102K	CHIP C 1000PF K		
C106			CC73FCH1H220J	CHIP C 22PF J		
C107			CK45B2H102K	CERAMIC 1000PF K		
C108			CM73F2H180J	CHIP C 18PF J		
C109			CC73FCH1H0R5C	CHIP C 0.5PF C		
C110			CC73FCH1H040C	CHIP C 4PF C		
C111-113			CK73FB1H102K	CHIP C 1000PF K		
C114			CC45SL2H390J	CERAMIC 39PF J		
C115			CC45SL2H470J	CERAMIC 47PF J		
C116			CC73FCH1H0R5C	CHIP C 0.5PF C		
C117			CC73FCH1H020C	CHIP C 2.0PF C		
C118			CM73F2H470J	CHIP C 47PF J		
C119			CK73FB1H102K	CHIP C 1000PF K		
C120			C92-0511-05	CHIP TAN 0.15UF 35WV		
C121			CK73EF1C105Z	CHIP C 1.0UF Z		
C122			CK73FB1H102K	CHIP C 1000PF K		
C123			CK73EF1C105Z	CHIP C 1.0UF Z		
C125			CM73F2H050D	CHIP C 5.0PF D		
C126			CC73FSL1H101J	CHIP C 100PF J		
C127			CK73FB1H332K	CHIP C 3300PF K		
C128			CM73F2H150J	CHIP C 15PF J		
C129			CC73FCH1H270J	CHIP C 27PF J	K2P2	
C201			CK73FB1H102K	CHIP C 1000PF K		
C202			CK73FB1H103K	CHIP C 0.010UF K		
C203			CK73FB1H102K	CHIP C 1000PF K		
C204			CK73FB1H103K	CHIP C 0.010UF K		
C205			CE04NW0J221M	ELECTRO 220UF 6.3WV		
C206			CK73FB1E223K	CHIP C 0.022UF K		
C207			CK73FB1H102K	CHIP C 1000PF K		
C208,209			CC73FCH1H330J	CHIP C 33PF J		
C210,211			CK73FB1H103K	CHIP C 0.010UF K		
C212-214			CC73FSL1H101J	CHIP C 100PF J		
C215-217			CK73FB1H102K	CHIP C 1000PF K		
C219,220			CK73FB1H103K	CHIP C 0.010UF K		
TC1			C05-0349-05	TRIMMING 10PF		
CN1			E40-3237-05	PIN CONNECTOR(INT.SP)		
CN2			E40-5182-05	PIN CONNECTOR(DRU)		
CN3 ,4			E40-5202-05	PIN CONNECTOR(TR)		

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CN5			E40-5183-05	PIN CONNECTOR(DTM)		
CN201,202			E40-5203-05	PIN CONNECTOR(CONT)		
CN203			E40-5185-05	PIN CONNECTOR(DRU)		
CN204			E40-5187-05	PIN CONNECTOR(DRU)		
CN205			E40-5341-05	PIN CONNECTOR		
J1			E11-0425-05	EXT SP JACK		
J201			E06-0860-05	MIC RECEPTACLE		
TP1 ,2			E23-0465-05	TEST TERMINAL		
W1			E33-1902-05	FINISHED WIRE SET(HET)		
W201			E31-6003-15	CONNECTING WIRE(CTCSS)		
W202			E33-1871-15	FINISHED WIRE SET	KPMEX	
W202			E33-1871-15	FINISHED WIRE SET	EM,E9	
W202			E33-1871-15	FINISHED WIRE SET	K2P2	
			J30-0564-05	SPACER		
			J31-0534-05	COLLAR (LED)		
CD1			L79-1013-05	CERAMIC DISCRI(CDBM455C16)		
CF1			L72-0372-05	CERAMIC FILTER(CFWM455F)		
L1 -4			L34-4080-05	COIL		
L5			L34-0956-05	COIL	KPXMM2	
L5			L34-0956-05	COIL	M3EE9	
L5			L34-0956-05	COIL	EM,E2	
L5			L34-4113-05	COIL	K2P2	
L6			L30-0005-05	COIL	KPXMM2	
L6			L30-0005-05	COIL	M3EE9	
L6			L30-0005-05	COIL	EM,E2	
L6			L34-2157-05	COIL	K2P2	
L7			L40-1001-48	SMALL FIXED INDUCTOR(10UH)		
L8			L34-1239-05	COIL		
L9			L34-0895-05	COIL		
L10			L34-0742-05	COIL		
L11			L34-0908-05	COIL		
L12 ,13			L34-0499-05	COIL		
L14			L40-3392-48	SMALL FIXED INDUCTOR(3.3UH)		
L15			L34-0499-05	COIL		
L16			L40-1095-48	SMALL FIXED INDUCTOR(1UH)	K2P2	
L17			L40-1892-19	SMALL FIXED INDUCTOR(1.8UH)	K2P2	
X1			L77-1473-05	CRYSTAL RESONATOR(10.245MHz)	KPXMM2	
X1			L77-1473-05	CRYSTAL RESONATOR(10.245MHz)	M3EE9	
X1			L77-1473-05	CRYSTAL RESONATOR(10.245MHz)	EM,E2	
X1			L77-1312-05	CRYSTAL RESONATOR(30.37MHz)	K2P2	
X2			L77-1405-05	CRYSTAL RESONATOR(12.8MHz)		
X201			L77-1397-05	CRYSTAL RESONATOR(4.194304MHz)		
XF1			L71-0228-15	CRYSTAL FILTER(10.7MHz)	KPXMM2	
XF1			L71-0228-15	CRYSTAL FILTER(10.7MHz)	M3EE9	
XF1			L71-0228-15	CRYSTAL FILTER(10.7MHz)	EM,E2	
XF1			L71-0270-05	CRYSTAL FILTER(30.825MHz)	K2P2	
R1			RK73FB2A682J	CHIP R 6.8K J 1/10W	KPX	
R1			RK73FB2A682J	CHIP R 6.8K J 1/10W	K2P2	
R2			RK73FB2A223J	CHIP R 22K J 1/10W	KPXMM2	
R2			RK73FB2A223J	CHIP R 22K J 1/10W	M3EE9	
R2			RK73FB2A223J	CHIP R 22K J 1/10W	EM,E2	
R2			R92-0670-05	CHIP R 0 OHM	K2P2	
R3			RK73FB2A274J	CHIP R 270K J 1/10W	KPXMM2	

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R3			RK73FB2A274J	CHIP R 270K J 1/10W	M3EE9	
R3			RK73FB2A274J	CHIP R 270K J 1/10W	EM,E2	
R4			RK73FB2A101J	CHIP R 100 J 1/10W		
R5			RK73FB2A103J	CHIP R 10K J 1/10W		
R6			RK73FB2A101J	CHIP R 100 J 1/10W		
R7			RK73FB2A104J	CHIP R 100K J 1/10W		
R8			RK73FB2A333J	CHIP R 33K J 1/10W	KPX	
R8			RK73FB2A333J	CHIP R 33K J 1/10W	K2P2	
R9 -11			RK73FB2A104J	CHIP R 100K J 1/10W		
R12 ,13			RK73FB2A473J	CHIP R 47K J 1/10W		
R14			RK73FB2A470J	CHIP R 47 J 1/10W		
R15			RK73FB2A274J	CHIP R 270K J 1/10W	KPXMM2	
R15			RK73FB2A274J	CHIP R 270K J 1/10W	M3EE9	
R15			RK73FB2A274J	CHIP R 270K J 1/10W	EM,E2	
R16			RK73FB2A470J	CHIP R 47 J 1/10W		
R17			RK73FB2A103J	CHIP R 10K J 1/10W		
R18			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R19			R92-0670-05	CHIP R 0 OHM	KPXMM2	
R19			R92-0670-05	CHIP R 0 OHM	M3EE9	
R19			R92-0670-05	CHIP R 0 OHM	EM,E2	
R20			RK73FB2A101J	CHIP R 100 J 1/10W		
R21			RK73FB2A471J	CHIP R 470 J 1/10W		
R22			RK73FB2A152J	CHIP R 1.5K J 1/10W	KPXMM2	
R22			RK73FB2A152J	CHIP R 1.5K J 1/10W	M3EE9	
R22			RK73FB2A152J	CHIP R 1.5K J 1/10W	EM,E2	
R23			RK73FB2A471J	CHIP R 470 J 1/10W	KPXMM2	
R23			RK73FB2A471J	CHIP R 470 J 1/10W	M3EE9	
R23			RK73FB2A471J	CHIP R 470 J 1/10W	EM,E2	
R23			RK73FB2A102J	CHIP R 1.0K J 1/10W	K2P2	
R24			RK73FB2A101J	CHIP R 100 J 1/10W		
R25			RK73FB2A103J	CHIP R 10K J 1/10W		
R26			RK73FB2A473J	CHIP R 47K J 1/10W		
R27			RK73FB2A272J	CHIP R 2.7K J 1/10W	KPX	
R27			RK73FB2A272J	CHIP R 2.7K J 1/10W	K2P2	
R28			RK73FB2A103J	CHIP R 10K J 1/10W		
R29			RK73FB2A681J	CHIP R 680 J 1/10W	KPX	
R29			RK73FB2A681J	CHIP R 680 J 1/10W	K2P2	
R30			RK73FB2A103J	CHIP R 10K J 1/10W	K2P2	
R30			RK73FB2A153J	CHIP R 15K J 1/10W	KPXMM2	
R30			RK73FB2A153J	CHIP R 15K J 1/10W	M3EE9	
R30			RK73FB2A153J	CHIP R 15K J 1/10W	EM,E2	
R31			RK73FB2A274J	CHIP R 270K J 1/10W	KPX	
R31			RK73FB2A274J	CHIP R 270K J 1/10W	K2P2	
R32			RK73FB2A332J	CHIP R 3.3K J 1/10W	KPX	
R32			RK73FB2A332J	CHIP R 3.3K J 1/10W	K2P2	
R33			RK73FB2A102J	CHIP R 1.0K J 1/10W	KPX	
R33			RK73FB2A102J	CHIP R 1.0K J 1/10W	K2P2	
R35 ,36			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R37			RK73FB2A334J	CHIP R 330K J 1/10W		
R38			RK73FB2A331J	CHIP R 330 J 1/10W		
R39			R92-0670-05	CHIP R 0 OHM	KPXMM2	
R39			R92-0670-05	CHIP R 0 OHM	M3EE9	
R39			R92-0670-05	CHIP R 0 OHM	EM,E2	
R40			RK73FB2A331J	CHIP R 330 J 1/10W		
R43			R92-1220-05	CHIP R 1 J 1/10W		

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TM-241E : (E,E2,E9,EM)

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PARTS LIST

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TX-RX UNIT (X57-369X-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
R44			RK73FB2A101J	CHIP R 100 J 1/10W		
R45			R92-0670-05	CHIP R 0 OHM		
R46			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R47			RK73FB2A473J	CHIP R 47K J 1/10W		
R48			RK73FB2A333J	CHIP R 33K J 1/10W		
R49			RK73FB2A473J	CHIP R 47K J 1/10W		
R50			RK73FB2A223J	CHIP R 22K J 1/10W		
R51			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R52			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R53			RK73FB2A334J	CHIP R 330K J 1/10W		
R54			RK73FB2A223J	CHIP R 22K J 1/10W		
R55			RK73FB2A182J	CHIP R 1.8K J 1/10W		
R56 -58			RK73FB2A103J	CHIP R 10K J 1/10W		
R59			RK73FB2A182J	CHIP R 1.8K J 1/10W		
R60			RK73FB2A223J	CHIP R 22K J 1/10W		
R61			RK73FB2A473J	CHIP R 47K J 1/10W		
R62			R92-0670-05	CHIP R 0 OHM		
R63			RK73FB2A102J	CHIP R 1.0K J 1/10W	EE2	
R63			RK73FB2A102J	CHIP R 1.0K J 1/10W	EM,E9	
R63			RK73FB2A332J	CHIP R 3.3K J 1/10W	KPXMM2	
R63			RK73FB2A332J	CHIP R 3.3K J 1/10W	M3K2P2	
R64			RK73FB2A332J	CHIP R 3.3K J 1/10W	K2P2	
R64			RK73FB2A392J	CHIP R 3.9K J 1/10W	KPMM2	
R64			RK73FB2A392J	CHIP R 3.9K J 1/10W	M3X	
R64			RK73FB2A563J	CHIP R 56K J 1/10W	EE9	
R64			RK73FB2A563J	CHIP R 56K J 1/10W	EM,E2	
R65 ,66			R92-0670-05	CHIP R 0 OHM		
R67			RK73FB2A220J	CHIP R 22 J 1/10W		
R68			R92-0670-05	CHIP R 0 OHM		
R69			RK73FB2A184J	CHIP R 180K J 1/10W		
R70 ,71			RK73FB2A103J	CHIP R 10K J 1/10W		
R72			R92-0670-05	CHIP R 0 OHM		
R73			RK73FB2A223J	CHIP R 22K J 1/10W		
R74			R92-0670-05	CHIP R 0 OHM		
R75 -78			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R79			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R80			RK73FB2A104J	CHIP R 100K J 1/10W		
R81			RK73FB2A471J	CHIP R 470 J 1/10W		
R82			RK73FB2A220J	CHIP R 22 J 1/10W		
R84			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R85			RK73FB2A220J	CHIP R 22 J 1/10W		
R86			RK73FB2A223J	CHIP R 22K J 1/10W		
R87			RK73FB2A103J	CHIP R 10K J 1/10W		
R88 ,89			RK73FB2A101J	CHIP R 100 J 1/10W		
R90			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R91			RK73FB2A470J	CHIP R 47 J 1/10W		
R92			RK73FB2A104J	CHIP R 100K J 1/10W		
R93			RK73FB2A102J	CHIP R 1.0K J 1/10W	K2P2	
R94			RK73FB2A220J	CHIP R 22 J 1/10W		
R95			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R96			RK73FB2A103J	CHIP R 10K J 1/10W		
R97			R92-1215-05	CHIP R 470 J 1/2W		
R98			RK73FB2A103J	CHIP R 10K J 1/10W		
R100			R92-0670-05	CHIP R 0 OHM		
R102			R92-0685-05	CHIP R 22 J 1/2W		

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TX-RX UNIT (X57-369X-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
R103			R92-1213-05	CARBON 100 J 1/2W		
R104,105			RK73FB2A223J	CHIP R 22K J 1/10W		
R106			RK73FB2A274J	CHIP R 270K J 1/10W	KPXMM2	
R106			RK73FB2A274J	CHIP R 270K J 1/10W	M3EE9	
R106			RK73FB2A274J	CHIP R 270K J 1/10W	EM,E2	
R107			R92-0670-05	CHIP R 0 OHM		
R108			RK73FB2A273J	CHIP R 27K J 1/10W		
R109			RK73FB2A103J	CHIP R 10K J 1/10W		
R110,111			RK73FB2A273J	CHIP R 27K J 1/10W		
R112			RK73FB2A104J	CHIP R 100K J 1/10W		
R113			RK73FB2A683J	CHIP R 68K J 1/10W		
R114			RK73FB2A151J	CHIP R 150 J 1/10W		
R201			RK73EB2B220J	CHIP R 22 J 1/8W		
R202			R92-0685-05	CHIP R 22 J 1/2W		
R203			R92-1259-05	FIXED RESISTOR(18 OHM)		
R204			R92-1262-05	METAL GLAZE 4.7 J 1/2W		
R205			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R207			RK73FB2A103J	CHIP R 10K J 1/10W		
R208			RK73FB2A471J	CHIP R 470 J 1/10W		
R209			RK73FB2A561J	CHIP R 560 J 1/10W		
R210			RK73FB2A563J	CHIP R 56K J 1/10W		
R211			RK73FB2A103J	CHIP R 10K J 1/10W		
R213			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R214			RK73FB2A474J	CHIP R 470K J 1/10W		
R215			R92-0670-05	CHIP R 0 OHM		
R216,217			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R218			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R219			R92-0670-05	CHIP R 0 OHM		
R220			R92-0670-05	CHIP R 0 OHM	M2M3	
R222			RK73FB2A151J	CHIP R 150 J 1/10W		
R223-225			RK73FB2A473J	CHIP R 47K J 1/10W		
R226-229			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R230			RK73FB2A473J	CHIP R 47K J 1/10W		
R231,232			RK73FB2A104J	CHIP R 100K J 1/10W		
R233			R92-0670-05	CHIP R 0 OHM		
R234			RK73FB2A104J	CHIP R 100K J 1/10W		
R235			RK73FB2A474J	CHIP R 470K J 1/10W		
R236,237			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R238			RK73FB2A474J	CHIP R 470K J 1/10W		
R239			RK73FB2A473J	CHIP R 47K J 1/10W		
R240			R92-0670-05	CHIP R 0 OHM		
R241			RK73FB2A473J	CHIP R 47K J 1/10W		
R242			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R243			RK73FB2A474J	CHIP R 470K J 1/10W		
R244			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R245			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R246			R90-0711-05	MULTI-COMP		
R247			RK73EB2B180J	CHIP R 18 J 1/8W		
VR1			R12-5058-05	TRIM POT. 100K		
VR3			R12-3132-05	TRIM POT. 47K		
VR4 ,5			R12-3126-05	TRIMMING POT.(10K)		
VR201			R05-3441-05	POTENTIOMETER(10KA)		
VR202			R05-4420-05	POTENTIOMETER(50KB)		
S201			S40-2458-05	PUSH SWITCH(POWER)		

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TX-RX UNIT (X57-369X-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti- nation 仕向	Re- marks 備考
S202-211			S40-1086-05	TACT SWITCH		
D1			DAN235K	DIODE	KPX	
D1			DAN235K	DIODE	K2P2	
D2 -4			1SV164	DIODE		
D5 ,6			1SV164	DIODE	KPXMM2	
D5 ,6			1SV164	DIODE	M3EE9	
D5 ,6			1SV164	DIODE	EM,E2	
D5 ,6			1SV166	DIODE	K2P2	
D7			LFB01	DIODE		
D8 ,9			1SS184	DIODE		
D10			DAN235K	DIODE		
D11			1SS181	DIODE		
D12			MI407	DIODE		
D13			MI308	DIODE		
D14 ,15			1SS226	DIODE		
D16			DSA3A1	DIODE		
D202			02CZ9.1(Y)	CHIP ZENER DIODE		
D203			1SS184	DIODE		
D204			1SS181	DIODE		
D205			1SS184	DIODE		
D206			1SS184	DIODE	KPMEM2	
D206			1SS184	DIODE	XEM,E9	
D206			1SS184	DIODE	M3K2P2	
D207			1SS184	DIODE	M2M3E	
D207			1SS184	DIODE	EM,E9	
D207			1SS184	DIODE	E2K2P2	
D208			1SS184	DIODE	K2P2	
D209			MA141A	CHIP DIODE	MM2EE2	
D209			MA141A	CHIP DIODE	EM,E9	
D209			MA141A	CHIP DIODE	M3K2P2	
D210			MA141A	CHIP DIODE	EE2	
D210			MA141A	CHIP DIODE	EM,E9	
D211			MA141A	CHIP DIODE		
D212			1SS226	DIODE		
D213			LFB01	DIODE		
D214			02CZ3.9(Z)	CHIP ZENER DIODE		
D215			02CZ3.0(Z)	CHIP ZENER DIODE		
D216			B30-0852-05	LED(LOW)		
D217			1SS184	DIODE		
IC1			KCD04	HIC(FM IF)		
IC2			TA7787AF	IC(FM/AM IF/3V)	KPX	
IC2			TA7787AF	IC(FM/AM IF/3V)	K2P2	
IC3			UPC1241H	IC(AF PA)		
IC4			KCC02	HIC(EL,VOL)		
IC5			TC9174F	IC(CMOS I/O EXTENSION)		
IC6			NJM78L05UA	IC(VOLTAGE REGULATOR/ +5V)		
IC7			LA5010M	IC(LOW SATURATION REGULATOR)		
IC8			KCB05	HIC(DRIVE)		
IC9			MC7808CT	IC(VOLTAGE REGULATORS/ +8V)		
IC201			75116GF-E83-3BE	IC(CPU)	KPXMM2	
IC201			75116GF-E83-3BE	IC(CPU)	M3EE9	
IC201			75116GF-E83-3BE	IC(CPU)	EM,E2	
IC201		*	75116GF-J64-3BE	IC(CPU)	K2P2	
IC202			NJM78L06UA	IC(VOLTAGE REGULATOR/ +6V)		

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TX-RX UNIT (X57-369X-XX)
PLL (X58-3470-00)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
Q1			3SK184(S)	FET		
Q2			DTA114YK	DIGITAL TRANSISTOR	KPX	
Q2			DTA114YK	DIGITAL TRANSISTOR	K2P2	
Q3			DTC123JK	DIGITAL TRANSISTOR	KPX	
Q3			DTC123JK	DIGITAL TRANSISTOR	K2P2	
Q4			3SK131(L)	FET		
Q5			2SC2714(Y)	TRANSISTOR		
Q6			2SK208(Y)	FET	KPX	
Q6			2SK208(Y)	FET	K2P2	
Q7			DTC143EK	DIGITAL TRANSISTOR	KPX	
Q7			DTC143EK	DIGITAL TRANSISTOR	K2P2	
Q8			2SC2712(Y)	TRANSISTOR	KPX	
Q8			2SC2712(Y)	TRANSISTOR	K2P2	
Q9			FMG2	TRANSISTOR		
Q10			2SC2712(Y)	TRANSISTOR		
Q12			2SD1757K	TRANSISTOR		
Q13 ,14			2SB1119(S)	TRANSISTOR		
Q15			DTC144WK	DIGITAL TRANSISTOR		
Q16 -18			2SC2712(Y)	TRANSISTOR		
Q19			2SD1757K	TRANSISTOR		
Q20			2SC2712(Y)	TRANSISTOR		
Q21			2SK208(Y)	FET		
Q22			2SC2714(Y)	TRANSISTOR		
Q23 ,24			DTC124EK	DIGITAL TRANSISTOR		
Q25			2SD1406(Y)	TRANSISTOR		
Q26			2SB1302(S)	TRANSISTOR		
Q27			2SC2712(Y)	TRANSISTOR		
Q28			2SJ106(GR)	FET		
Q201-204			2SA1519	TRANSISTOR		
Q205			2SD1682(R,S)	TRANSISTOR		
Q206-208			2SC2712(Y)	TRANSISTOR		
Q209,210			DTC114EK	DIGITAL TRANSISTOR		
Q211			DTD143EK	DIGITAL TRANSISTOR		
Q212			FMG2	TRANSISTOR		
S212			W02-0388-05	ROTARY ENCODER		
			X58-3470-00	SUB UNIT(PLL)	KPXMM2	
			X58-3470-00	SUB UNIT(PLL)	M3EE9	
			X58-3470-00	SUB UNIT(PLL)	EM,E2	
		*	X58-3500-11	SUB UNIT(PLL)	K2,P2	
			X59-3130-00	MODULE UNIT(APC)		
			X59-3610-00	MODULE UNIT(MIC AMP)		
PLL (X58-3470-00) : (K,P,X,M,M2,M3,E,E2,E9,EM)						
C1			CC73FCH1H220J	CHIP C 22PF J		
C2			CK73FB1H102K	CHIP C 1000PF K		
C3			CC73FCH1H020C	CHIP C 2.0PF C		
C4 ,5			CK73FB1H472K	CHIP C 4700PF K		
C6			CC73FCH1H020C	CHIP C 2.0PF C		
C7 -9			CK73FB1H102K	CHIP C 1000PF K		
C10			CK73FB1H472K	CHIP C 4700PF K		
C11			CK73FB1H102K	CHIP C 1000PF K		
C51			CC73FCH1H100D	CHIP C 10PF D		
C52			CK73FB1H102K	CHIP C 1000PF K		
C53			CC73FCH1H100D	CHIP C 10PF D		

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PLL (X58-3470-00)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
C54			CK73FB1H102K	CHIP C 1000PF K		
C55			CK73EB1H223K	CHIP C 0.022UF K		
C56			CK73FB1E393K	CHIP C 0.039UF K		
C101			CK73EB1H223K	CHIP C 0.022UF K		
C102,103			C92-0009-05	CHIP TAN 4.7UF 10WV		
C104			CK73FB1H102K	CHIP C 1000PF K		
C105			C92-0003-05	CHIP TAN 0.47UF 25WV		
C106			CK73EB1H223K	CHIP C 0.022UF K		
C107			CC73FCH1H100D	CHIP C 10PF D		
C108			CC73FCH1H220J	CHIP C 22PF J		
C109,110			CK73FB1H102K	CHIP C 1000PF K		
CN1			E40-0311-05	PIN CONNECTOR(3P)		
CN2			E40-0411-05	PIN CONNECTOR(4P)		
CN3			E40-5201-05	PIN CONNECTOR(7P)		
			F11-1122-24	SHIELDING COVER		
L1			L40-1581-80	SMALL FIXED INDUCTOR(150NH)		
L2 -4			L40-4791-19	SMALL FIXED INDUCTOR(4.7UH)		
L5			L34-2336-05	COIL		
L51			L40-3392-81	SMALL FIXED INDUCTOR(3.3UH)		
R1			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R2			RK73FB2A561J	CHIP R 560 J 1/10W		
R3			RK73FB2A101J	CHIP R 100 J 1/10W		
R4			RK73FB2A121J	CHIP R 120 J 1/10W		
R5			RK73FB2A470J	CHIP R 47 J 1/10W		
R6 ,7			R92-0670-05	CHIP R 0 OHM		
R8			RK73FB2A101J	CHIP R 100 J 1/10W		
R9			RK73FB2A470J	CHIP R 47 J 1/10W		
R10			RK73FB2A103J	CHIP R 10K J 1/10W		
R51			RK73FB2A103J	CHIP R 10K J 1/10W		
R52			RK73FB2A223J	CHIP R 22K J 1/10W		
R53			RK73FB2A221J	CHIP R 220 J 1/10W		
R54			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R55			RK73FB2A473J	CHIP R 47K J 1/10W		
R101			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R102			R92-0670-05	CHIP R 0 OHM		
R103			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R104			R92-0670-05	CHIP R 0 OHM		
R105			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R106			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R107-111			RK73FB2A473J	CHIP R 47K J 1/10W		
R112			RK73FB2A223J	CHIP R 22K J 1/10W		
R113			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R114			R92-0670-05	CHIP R 0 OHM		
D1 ,2			1T33C	DIODE		
IC51			M54959FP	IC(FREQ SYNTHESIZER PLL)		
Q1			2SC2714(Y)	TRANSISTOR		
Q2			2SK508NV(K52)	FET		
Q51			2SC2714(Y)	TRANSISTOR		
Q52			DTC144EK	DIGITAL TRANSISTOR		
Q53			2SC2712(Y)	TRANSISTOR		
Q101,102			2SC3324(B)	TRANSISTOR		

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TM-241E : (E,E2,E9,EM)

⚠ indicates safety critical components.

PARTS LIST

⁎ New Parts

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PLL (X58-3500-11)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
				PLL (X58-3500-11) : (K2,P2)		
C1			CK73FB1E223K	CHIP C 0.022UF K		
C2 ,3			CK73FB1H102K	CHIP C 1000PF K		
C4			CK73FB1E223K	CHIP C 0.022UF K		
C5			CK73FB1H471K	CHIP C 470PF K		
C6 ,7			C92-0507-05	CHIP TAN 4.7UF 6.3WV		
C8			C92-0003-05	CHIP TAN 0.47UF 25WV		
C9			CK73EB1E473K	CHIP C 0.047UF K		
C10			CC73FCH1H050C	CHIP C 5PF C		
C11 ,12			CK73FB1H102K	CHIP C 1000PF K		
C13 ,14			CK73FB1E223K	CHIP C 0.022UF K		
C15			CC73GCH1H100D	CHIP C 10PF D		
C16			CC73GCH1H220J	CHIP C 22PF J		
C101			CK73GB1E103K	CHIP C 0.010UF K		
C103,104			CK73GB1E103K	CHIP C 0.010UF K		
C105			CC73GCH1H010C	CHIP C 1PF C		
C106			CC73GCH1H220J	CHIP C 22PF J		
C107,108			CK73GB1H102K	CHIP C 1000PF K		
C109,110			CK73GB1E103K	CHIP C 0.010UF K		
C111			CC73GCH1H030C	CHIP C 3PF C		
C112,113			CK73GB1E103K	CHIP C 0.010UF K		
C114			CC73GCH1H010C	CHIP C 1PF C		
C115			CC73GCH1H220J	CHIP C 22PF J		
C116			CK73GB1H102K	CHIP C 1000PF K		
CN1			E40-5201-05	PIN CONNECTOR (7P)		
CN101			E40-0411-05	PIN CONNECTOR (4P)		
CN102			E40-0311-05	PIN CONNECTOR (3P)		
			F11-1122-24	SHIELDING COVER		
L1			L40-3391-19	SMALL FIXED INDUCTOR(3.3UH)		
L101,102			L40-4791-19	SMALL FIXED INDUCTOR(4.7UH)		
L103			L34-2331-05	COIL		
L104-106			L40-4791-19	SMALL FIXED INDUCTOR(4.7UH)		
L107			L34-2332-05	COIL		
L108			L40-4791-19	SMALL FIXED INDUCTOR(4.7UH)		
R1 -5			RK73GB1J473J	CHIP R 47K J 1/16W		
R6			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R7			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R8			RK73GB1J392J	CHIP R 3.9K J 1/16W		
R9			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R10 ,11			RK73GB1J103J	CHIP R 10K J 1/16W		
R13			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R14			RK73GB1J473J	CHIP R 47K J 1/16W		
R15			RK73GB1J223J	CHIP R 22K J 1/16W		
R16			RK73GB1J103J	CHIP R 10K J 1/16W		
R17			RK73GB1J221J	CHIP R 220 J 1/16W		
R18			R92-1252-05	CHIP R 0 OHM		
R101			RK73GB1J101J	CHIP R 100 J 1/16W		
R102			RK73GB1J470J	CHIP R 47 J 1/16W		
R103			RK73GB1J101J	CHIP R 100 J 1/16W		
R104			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R105			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R106			RK73GB1J471J	CHIP R 470 J 1/16W		

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PLL (X58-3500-11)
APC (X59-3130-00)
MIC AMP (X59-3610-00)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
R107			RK73GB1J101J	CHIP R 100 J 1/16W		
R108			RK73GB1J470J	CHIP R 47 J 1/16W		
R109			RK73GB1J682J	CHIP R 6.8K J 1/16W		
R110			RK73GB1J470J	CHIP R 47 J 1/16W		
R111			RK73GB1J101J	CHIP R 100 J 1/16W		
R112			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R113			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R114			RK73GB1J471J	CHIP R 470 J 1/16W		
D101,102			1SV166	DIODE		
D103			1T33C	DIODE		
D104			1SV166	DIODE		
IC1			M54959FP	IC(FREQ SYNTHESIZER PLL)		
Q1			2SC2713(B)	TRANSISTOR Or2SC3324(B)		
Q2			2SC3324(G)	TRANSISTOR Or2SC3324(B)		
Q3			2SC2712(Y)	TRANSISTOR		
Q4			2SC2714(Y)	TRANSISTOR		
Q101			2SK508NV(K52)	FET		
Q102			DTC114EK	DIGITAL TRANSITOR		
Q103			2SC3120	TRANSISTOR		
Q104			2SK508NV(K52)	FET		
Q105			DTC114EK	DIGITAL TRANSITOR		
Q106			2SC3120	TRANSISTOR		
APC (X59-3130-00)						
C1			CK73FB1H102K	CHIP C 1000PF K		
C2			C92-0501-05	CHIP TAN 1.5UF 10WV		
C3			CK73FB1H472K	CHIP C 4700PF K		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5			CK73FB1H472K	CHIP C 4700PF K		
C6			CK73FB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R1			RD41FB2B222J	CARBON 2.2K J 1/8W		
R2			RD41FB2B102J	CARBON 1K J 1/8W		
R3			RD41FB2B152J	CARBON 1.5K J 1/8W		
R4 ,5			RD41FB2B103J	CARBON 10K J 1/8W		
R6			RD41FB2B122J	CARBON 1.2K J 1/8W		
Q1 ,2			FMW1	TRANSISTOR		
Q3			2SA1162(Y)	TRANSISTOR		
MIC AMP (X59-3610-00)						
C1			CK73FF1E104Z	CHIP C 0.1UF Z		
C2			CK73GB1H102K	CHIP C 1000PF K		
C3			CK73FB1E333K	CHIP C 0.033UF K		
C4			CC73GCH1H270J	CHIP C 27PF J		
C5			C92-0004-05	ELECTRO 1.0UF 16WV		
C6			CK73FB1E333K	CHIP C 0.033UF K		
C7			CK73GB1H681K	CHIP C 680PF K		
C8			CK73GB1H332K	CHIP C 3300PF K		
C9			CC73GCH1H820J	CHIP C 82PF J		
C10			CC73GCH1H101J	CHIP C 100PF J		
C11			CK73GB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R1			RK73GB1J223J	CHIP R 22K J 1/16W		

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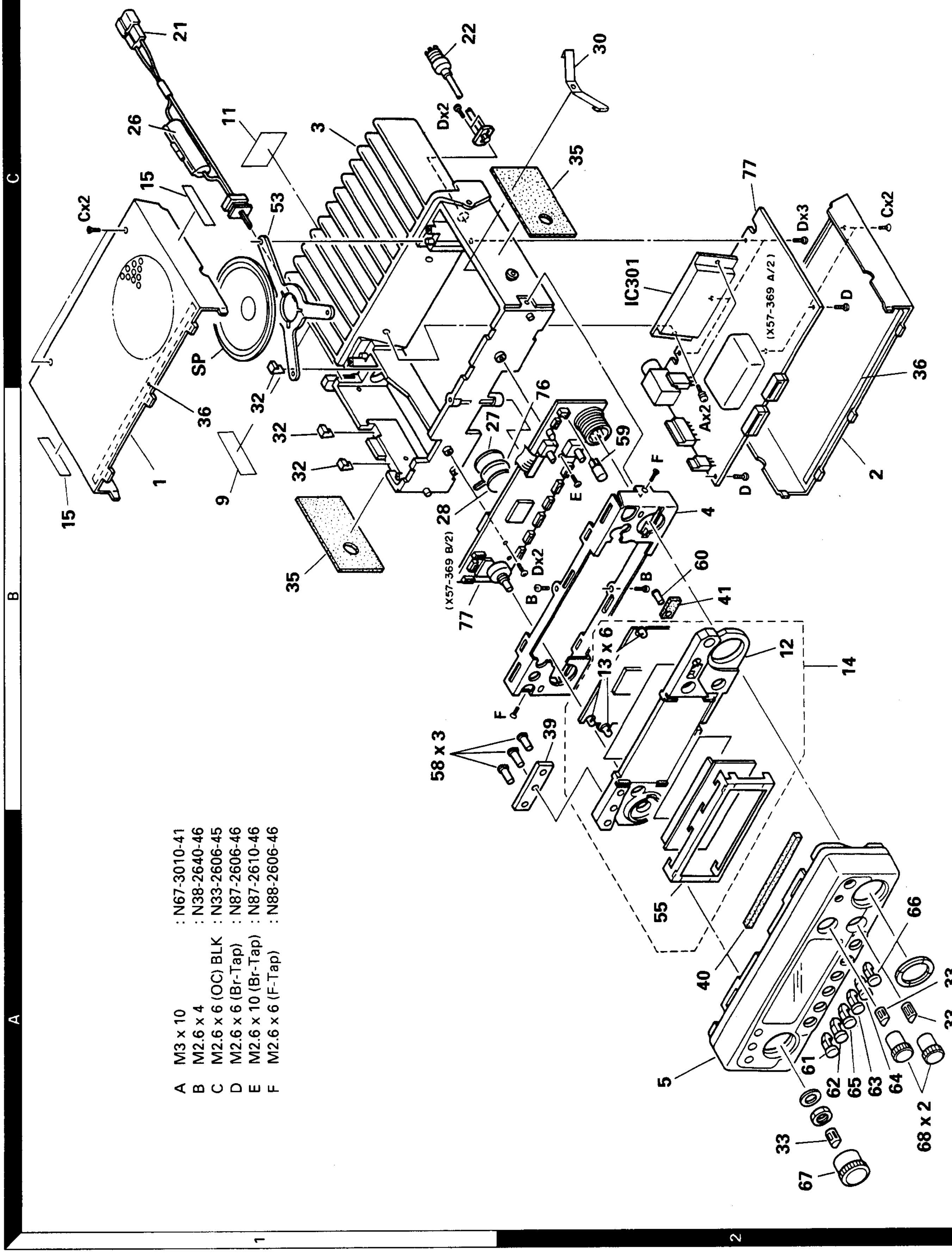
MIC AMP (X59-3610-00)

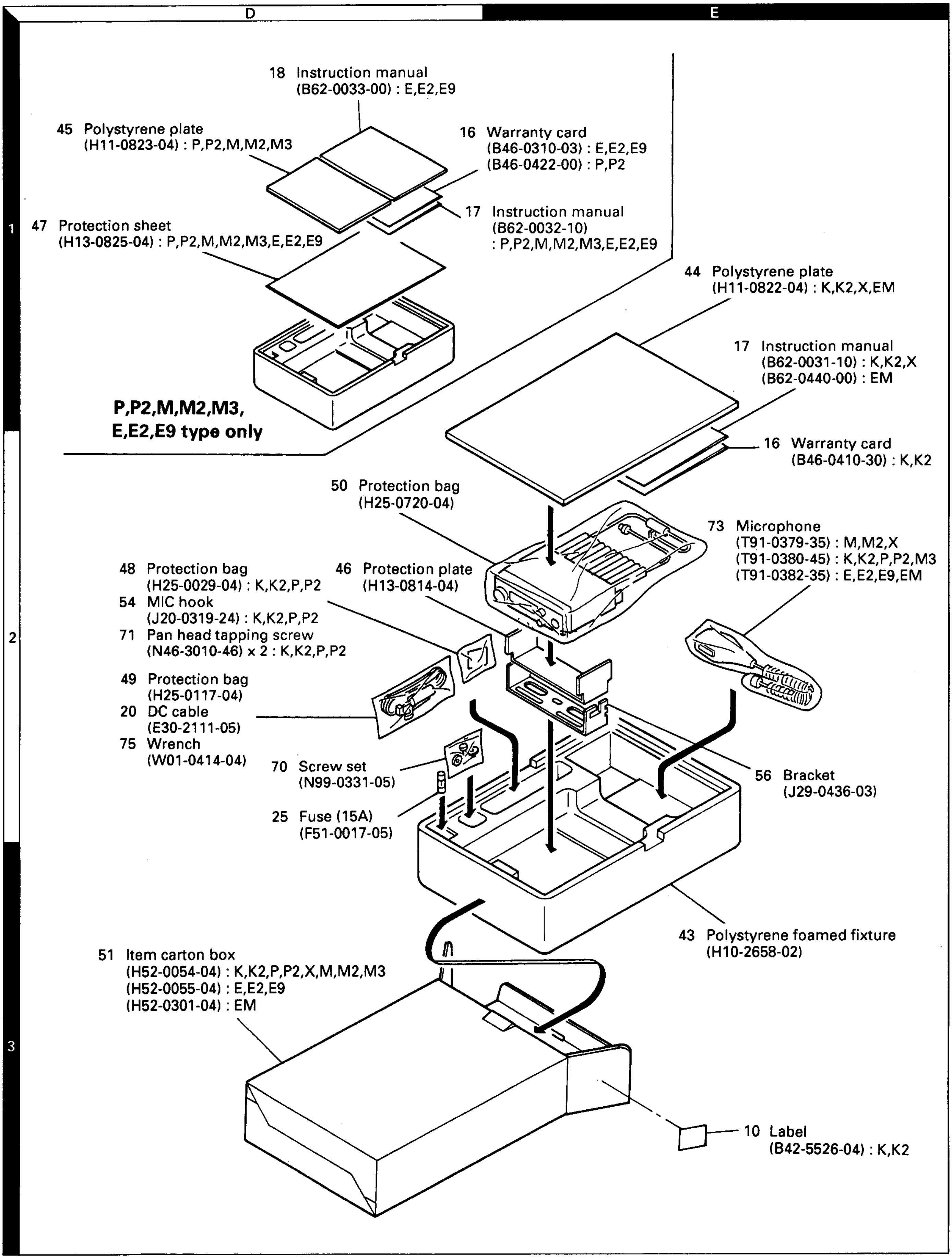
Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
R2			RK73GB1J104J	CHIP R 100K J 1/16W		
R3			RK73GB1J561J	CHIP R 560 J 1/16W		
R4			RK73GB1J470J	CHIP R 47 J 1/16W		
R5			RK73GB1J561J	CHIP R 560 J 1/16W		
R6			R92-1252-05	CHIP R 0 OHM		
R7			RK73GB1J394J	CHIP R 390K J 1/16W		
R8			RK73GB1J224J	CHIP R 220K J 1/16W		
R9			RK73GB1J184J	CHIP R 180K J 1/16W		
R10			RK73GB1J333J	CHIP R 33K J 1/16W		
R11			RK73FB2A473J	CHIP R 47K J 1/10W		
R12			RK73GB1J224J	CHIP R 220K J 1/16W		
R13 -15			RK73GB1J823J	CHIP R 82K J 1/16W		
R16			R92-1252-05	CHIP R 0 OHM		
IC1			NJM4558M	IC(OP AMP X2)		
Q1			2SC4116(GR)	TRANSISTOR		

EXPLODED VIEW


21
22
30
26
11
Dx2
3
35
15
Cx2
53
77
Dx3
Cx2
IC301
(X57-369 A/2)
D
SP
36
32
76
32
27
59
Ax2
36
32
F
E
D
2
1
9
28
15
35
(X57-369 B/2)
Dx2
4
60
B
77
B
41
13 x 6
12
14
F
39
58 x 3
55
66
40
33
33
5
61
62
65
63
64
68 x 2
33
67
A
B
C
1
2

A	M3 x 10	: N67-3010-41
B	M2.6 x 4	: N38-2640-46
C	M2.6 x 6 (OC) BLK	: N33-2606-45
D	M2.6 x 6 (Br-Tap)	: N87-2606-46
E	M2.6 x 10 (Br-Tap)	: N87-2610-46
F	M2.6 x 6 (F-Tap)	: N88-2606-46

PACKING


D
E
1
2
3
18 Instruction manual
(B62-0033-00) : E,E2,E9
45 Polystyrene plate
(H11-0823-04) : P,P2,M,M2,M3
16 Warranty card
(B46-0310-03) : E,E2,E9
(B46-0422-00) : P,P2
47 Protection sheet
(H13-0825-04) : P,P2,M,M2,M3,E,E2,E9
17 Instruction manual
(B62-0032-10)
: P,P2,M,M2,M3,E,E2,E9
44 Polystyrene plate
(H11-0822-04) : K,K2,X,EM
17 Instruction manual
(B62-0031-10) : K,K2,X
(B62-0440-00) : EM
P,P2,M,M2,M3,
E,E2,E9 type only
16 Warranty card
(B46-0410-30) : K,K2
50 Protection bag
(H25-0720-04)
73 Microphone
(T91-0379-35) : M,M2,X
(T91-0380-45) : K,K2,P,P2,M3
(T91-0382-35) : E,E2,E9,EM
48 Protection bag
(H25-0029-04) : K,K2,P,P2
54 MIC hook
(J20-0319-24) : K,K2,P,P2
71 Pan head tapping screw
(N46-3010-46) x 2 : K,K2,P,P2
46 Protection plate
(H13-0814-04)
49 Protection bag
(H25-0117-04)
20 DC cable
(E30-2111-05)
75 Wrench
(W01-0414-04)
70 Screw set
(N99-0331-05)
25 Fuse (15A)
(F51-0017-05)
56 Bracket
(J29-0436-03)
43 Polystyrene foamed fixture
(H10-2658-02)
51 Item carton box
(H52-0054-04) : K,K2,P,P2,X,M,M2,M3
(H52-0055-04) : E,E2,E9
(H52-0301-04) : EM
10 Label
(B42-5526-04) : K,K2

ADJUSTMENT

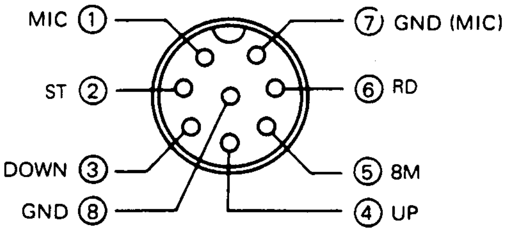
Required Test Equipment

1. DC V.M and Tester
   High input impedance
2. RF VTVM (RF V.M)
   Input impedance : 1MΩ min., 2pF max.
   Voltage range : F.S = 10mV to 300V
   Frequency range : Up to 450MHz
3. Frequency Counter (f. counter)
   Input sensitivity : Approx. 50mV
   Frequency range : Up to 450MHz
4. DC Power Supply
   Voltage : 10V to 17V, variable
   Current : 11A min.
5. Power Meter
   Measurement range : Approx. 60W, 3W, 1W
   Input impedance : 50Ω
   Frequency range : 450MHz
6. AF VTVM (AF V.M)
   Input impedance : 1MΩ min.
   Voltage range : F.S = 1mV to 30V
   Frequency range : 50Hz to 10kHz
7. AF Generator (AG)
   Output frequency : 100Hz to 10kHz
   Output voltage : 0.5mV to 1V
8. Linear Detector
   Frequency range : 450MHz
9. Spectrum Analyzer
   Frequency range : 450MHz
10. Directional Coupler
11. Oscilloscope
    High sensitivity oscilloscope with horizontal input terminal
12. SSG
    Frequency range : 144MHz band
    Modulation : AM and FM MOD.
    Output level : 0.1μV to 100mV
13. Dummy Load
    8Ω, 5W (approx.)
14. Noise Generator
    Must generate ignition-like noise containing harmonics beyond 450MHz
15. Sweep Generator
    Sweep range : 144MHz band
16. Tracking Generator

Preparation

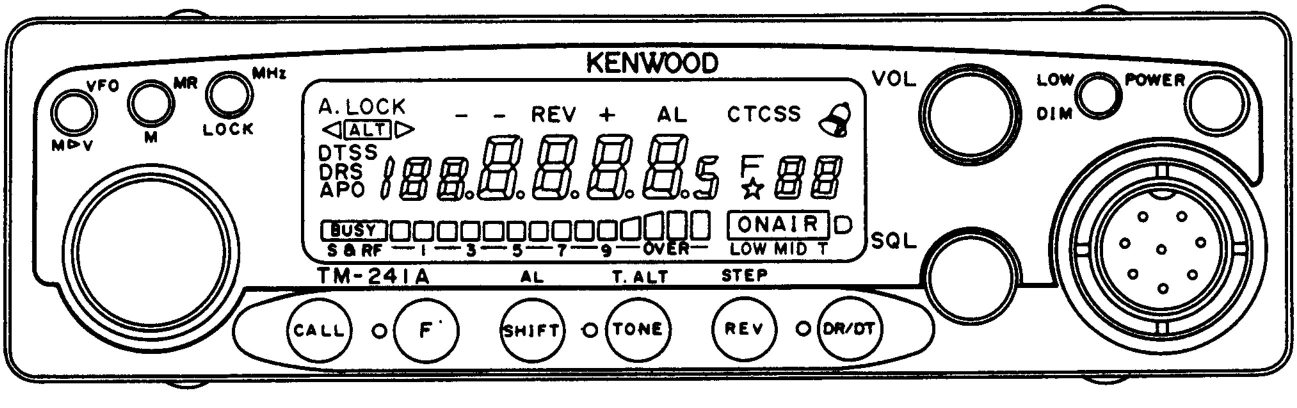
- Unless otherwise specified, knobs and switches should be set as follows.

POWER SW	ON	CALL	OFF
AF VOL VR	MIN	SHIFT/AL	OFF
SQL VOL VR	MIN	TONE/T. ALT	OFF
VFO	VFO	REV/STEP	OFF
MR	OFF	DR/DT	OFF


MIC ①
⑦ GND (MIC)
ST ②
⑥ RD
DOWN ③
⑤ 8M
GND ⑧
④ UP

MIC terminals (view from front panel side)

- Use an insulated adjusting rod to adjust trimmers and coils.
- To prevent damaging SSG, never set the standby switch to SEND while adjusting the receiver section.
- Be sure to turn the power switch OFF, before connecting the power cable to a power source.
- Meter and display section should be set as follows.


KENWOOD
VFO
MR
MHz
M▷V
M
LOCK
A. LOCK
◁ALT▷
DTSS
DRS
APO
- - REV + AL CTCSS
BUSY
S & RF 1 3 5 7 9 OVER
ONAIR
LOW MID T
TM-241A
AL
T. ALT
STEP
VOL
LOW
POWER
DIM
SQL
CALL
F
SHIFT
TONE
REV
DR/DT

ADJUSTMENT

Common Section

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Setting	1) Source voltage : DC 13.8V POWER SW : OFF VOL VR : Full counterclockwise (CCW). SQL VR : CCW TX-RX unit VR3, 4 : CCW VR1 : Center							
2. Reset	1) Turn POWER SW ON while holding down MR/M.						Check	Display : 144.000
3. PLL	1) RX VCO FREQ. : 144.975MHz **E,E2,E9,EM** FREQ. : 146.000MHz **K,K2,P,P2,X,M,M2,M3** Receive.	DC V.M Dummy	TX-RX (A/2) Rear panel	TP2 ANT			Check	1.7~2.4V **K,P,X,M,M2,M3, E,E2,E9,EM** 2.5V or more. **K2,P2**
	2) FREQ. : 136.000MHz **K,P,X,M,M2,M3** Receive.							1.0V or more. **K,P,X,M,M2,M3**
	3) TX VCO FREQ. : 144.975MHz **E,E2,E9,EM** FREQ. : 146.000MHz **K,K2,P,P2,X,M,M2,M3** Transmit.							3.2~3.8V **K,P,X,M,M2,M3, E,E2,E9,EM** 4.5~6.5V **K2,P2**
	4) FREQ. : 173.995MHz **M2,M3,E2** Transmit.							10V or less. **M2,M3,E2**
4. Transmit frequency adjustment	1) FREQ. : 144.975MHz **E,E2,E9,EM** FREQ. : 146.000MHz **K,K2,P,P2,X,M,M2,M3** Transmit.	f. counter Power meter	Rear panel	ANT	TX-RX (A/2)	TC1	144.975MHz **E,E2,E9,EM** 146.000MHz **K,K2, P,P2,X,M,M2,M3**	±100Hz

Receiver Section

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. BPF	1) FREQ. : 145.050MHz **E,E2,E9,EM** FREQ. : 146.040MHz **K,K2,P,P2,X,M,M2,M3** TX-RX unit VR1 : Center Connect the SSG to ANT. Connect the DC V.M to TP1 SSG output : −113dBm/0.5µV MOD : 1kHz DEV : 3kHz	DC V.M SSG	TX-RX (A/2)	TP1	TX-RX (A/2)	L1~5	Repeat for MAX. **K,P,X,M,M2,M3, E,E2,E9,EM** L4 turn to 180° CCW after adjust the peak. Repeat for MAX. Then L4 turn to 180° CCW. **K2,P2**	
2. Distortion	1) FREQ. : 145.050MHz **E,E2,E9,EM** FREQ. : 146.040MHz **K,K2,P,P2,X,M,M2,M3** SSG output : −113dBm/0.5µV MOD : 1kHz DEV : 3kHz	Distortion meter Oscilloscope	Rear panel	SP	TX-RX (A/2)	L6	Repeat for MIN. **K,P,X,M,M2,M3, E,E2,E9,EM** Repeat for MIN. Then turn to CCW and adjust to 2% distortion. **K2,P2**	Turn L6 core CCW until best SINAD point obtained.

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
3. Receiving sensitivity	1) FREQ. : 145.050MHz **E,E2,E9,EM** FREQ. : 146.040MHz **K,K2,P,P2,X,M,M2,M3** SSG output : –123dBm/0.16µV **K,P,X,M,M2,M3,E,E2,E9,EM** SSG output : –119dBm/0.25µV **K2,P2** MOD : 1kHz DEV : 3kHz	AF V.M Oscilloscope	Rear panel	SP			Check	SINAD 12dB or more.
	2) FREQ. : 144.040MHz **K,K2,P,P2,X,M,M2,M3** FREQ. : 144.050MHz **E,E2,E9,EM**							
	3) FREQ. : 145.950MHz **E,E2,E9,EM** FREQ. : 147.940MHz **K,K2,P,P2,X,M,M2,M3**							
4. S-meter	1) FREQ. : 145.050MHz **E,E2,E9,EM** FREQ. : 146.040MHz **K,K2,P,P2,X,M,M2,M3** SSG output : –96dBm/3.6µV MOD : 1kHz DEV : 3kHz	LCD (S-meter)			TX-RX (A/2)	VR1	Adjust so that all the S-meter go on, then the last segment goes off.	
	2) SSG output : –95dBm/4µV						Check	All S-meter segments on.
	3) SSG output : OFF							S-meter off.

Transmitter Section

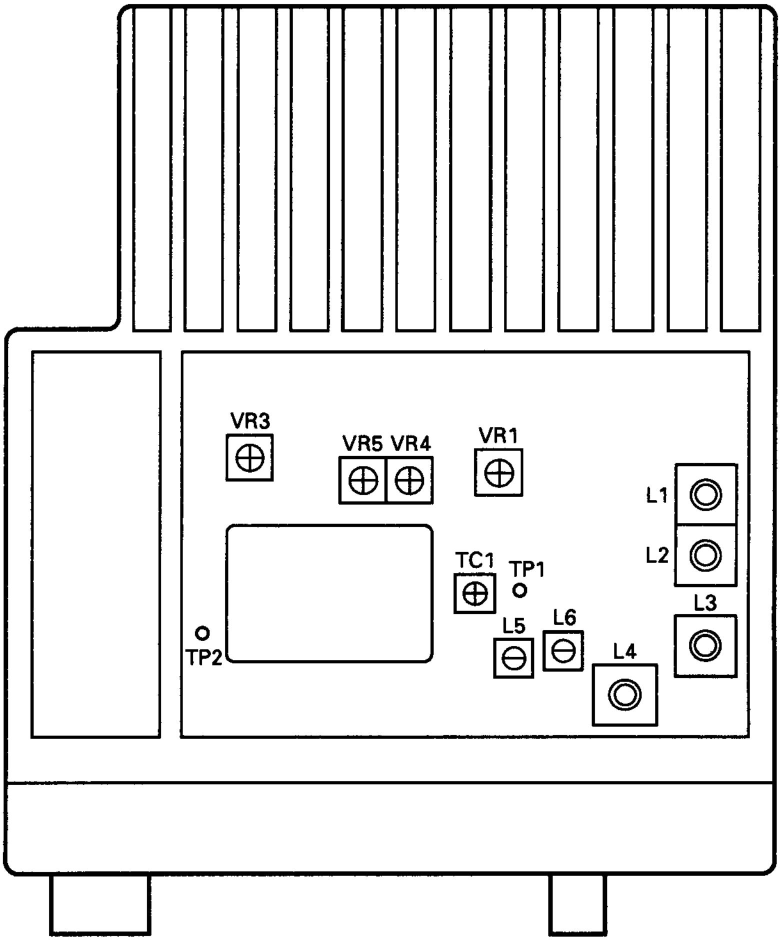
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1-1. Power (APC)	1) FREQ. : 144.975MHz **E,E2,E9,EM** FREQ. : 146.000MHz **K,K2,P,P2,X,M,M2,M3** Transmit.	Power meter Ammeter	Rear panel	ANT			Check	57W or more. ON AIR LED on.
	2) FREQ. : 145.975MHz **E,E2,E9,EM** FREQ. : 147.995MHz **K,K2,P,P2,X,M,M2,M3** Transmit.				TX-RX (A/2)	VR4	54W	±1W 11A or less.
	3) FREQ. : 144.000MHz Transmit.						Check Read RF meter.	49~59W 11A or less. All RF meter LEDs on.
	4) FREQ. : 144.975MHz **E,E2,E9,EM** FREQ. : 146.000MHz **K,K2,P,P2,X,M,M2,M3** Transmit.							

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1-2. MID power	1) FREQ. : 144.975MHz **E,E2,E9,EM** FREQ. : 146.000MHz **K,K2,P,P2,X,M,M2,M3** LOW SW : Push Transmit.	Power meter Ammeter	Rear panel	ANT	TX-RX (A/2)	VR5	12W Read RF meter.	±1W 10 RF meter LEDs on.
1-3. LOW power	1) FREQ. : 144.975MHz **E,E2,E9,EM** FREQ. : 146.000MHz **K,K2,P,P2,X,M,M2,M3** LOW SW : Push Transmit.						Check Read RF meter.	3.0~8.0W 6 RF meter LEDs on.
2. DEV.	1) FREQ. : 144.975MHz **E,E2,E9,EM** FREQ. : 146.000MHz **K,K2,P,P2,X,M,M2,M3** AG : 1kHz/28mV **E,E2,E9,EM** AG : 1kHz/50mV **K,K2,P,P2,X,M,M2,M3** Transmit.	Linear detector Oscilloscope Power meter	Rear panel	ANT	TX-RX (A/2)	VR3	±4.4kHz (Read higher absolute value of + or – value.)	±200Hz Check for detected waveform.
	2) AG : 1kHz/2.8mV **E,E2,E9,EM** AG : 1kHz/5.0mV **K,K2,P,P2,X,M,M2,M3** Transmit.						Check	±2.2~3.6kHz
	3) DTSS AG : 1.6kHz/175mV (CN5 input) Transmit.						Check	±2.5kHz or more.
3. Protection	1) FREQ. : 145.975MHz **E,E2,E9,EM** FREQ. : 147.995MHz **K,K2,P,P2,X,M,M2,M3** ANT : Open Transmit.	Ammeter	Rear panel	ANT			Check	11A or less.
4. TONE	1) FREQ. : 145.250MHz TONE : ON Transmit.	Linear detector Oscilloscope Power meter	Rear panel	ANT			Check	DEV. : ±0.5~1.0kHz
	2) FREQ. : 144.975MHz **E,E2,E9,EM** TONE SW of MIC : ON Transmit.							DEV. : ±2.5~5.0kHz

ADJUSTMENT

Adjustment Points (Top View)


VR3
VR5
VR4
VR1
L1
L2
L3
TC1
TP1
L5
L6
L4
TP2

TX-RX UNIT (X57-369X-XX)

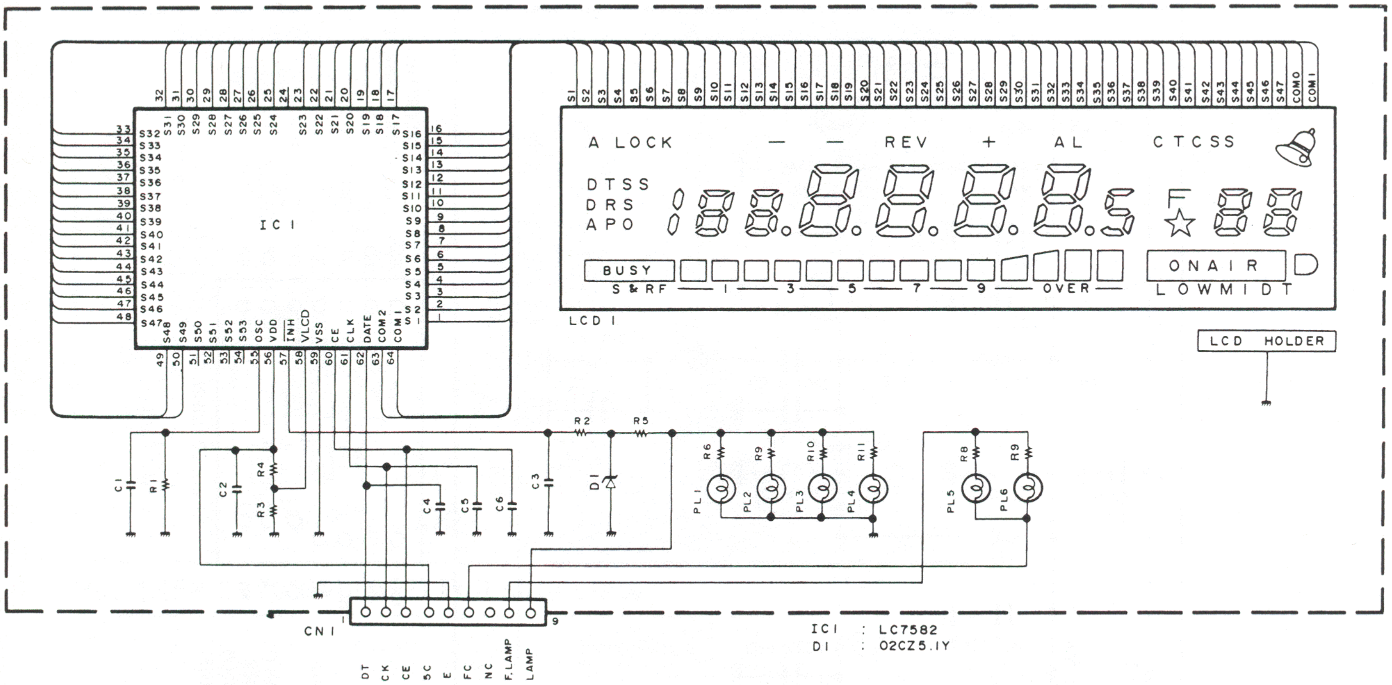
VR1 : S-meter
VR3 : ±4.4kHz at 1kHz, 28mV (E,E2,E9,EM)
VR3 : ±4.4kHz at 1kHz, 50mV (K,P,X,M,M2,M3,K2,P2)
VR4 : APC
VR5 : MIC POWER
L1~5 : BPF
L6 : Distortion
TC1 : TX frequency

TERMINAL FUNCTION

CN No.	Pin No.	Name	Function
TX-RX UNIT (X57-369X-XX) (A/2)			
CN1	1	E	GND.
	2	SP	Speaker input.
CN2	1	BZ2	
	2	E	GND.
	3	VI	Voice memory input.
	4	VO	Voice memory output.
	5	VOA	Power supply for voice memory.
CN3	1	E	GND.
	2	NC	
	3	ES1	Shift register (IC5) enable.
	4	NC	
	5	EP1	PLL enable.
	6	CK	PLL clock.
	7	DT	PLL data.
	8	DET	CTCSS detector output.
	9	RD	Audio output.
	10	SC	Squelch busy control output.
	11	SQ	Squelch output.
	12	SM	S-meter output.
	13	E	GND.
CN4	1	E	GND.
	2	B	+13.8V.
	3	PSW	Power switch control input.
	4	SB	Switched B.
	5	8C	Common +8V.
	6	BZ	Beep input (To AF IC from CPU).
	7	A2	Audio input (To electronic volume from AF VOL).
	8	A1	Audio output (To AF VOL).
	9	AE	GND.
	10	TO	Tone input.
	11	ME	MIC GND.
	12	MIC	Mic input (To MIC AMP unit).
	13	E	GND.
TX-RX UNIT (X57-369X-XX) (B/2)			
CN201	1	E	GND.
	2	NC	
	3	ES1	Shift register enable (From CPU IC201).
	4	NC	
	5	EP1	PLL enable (From CPU IC201).
	6	CK	PLL clock (From CPU IC201).
	7	DT	PLL data (From CPU IC201).
	8	DET	CTCSS detector output.
	9	RD	Audio input (CPU IC201).
	10	SC	Squelch busy control input (To CPU IC201).
	11	SQ	Squelch input (To CPU IC201).
	12	SM	S-meter input (To CPU IC201).
	13	E	GND.
CN202	1	E	GND.
	2	B	+13.8V.
	3	PSW	Power switch control output (From CPU).
	4	SB	Switched B.
	5	8C	Common +8V.
	6	BZ	Beep output (From CPU).
	7	A2	Audio output (To electronic volume from AF VOL).
	8	A1	Audio input (To AF VOL).
	9	AE	GND.
	10	TO	Tone output (From IC203).
	11	ME	MIC GND.
	12	MIC	Mic output (From mic jack).
	13	E	GND.
CN203	1	CK	Serial clock output (From CPU P21).
	2	DT	Serial data output (From CPU P22).
	3	VCK	DRS unit connect check.
	4	GND	GND.
	5	D8	DRS unit data.
	6	D1	DRS unit data.
	7	D2	DRS unit data.
	8	D4	DRS unit data.
CN204	1	DST	
	2	C5	Common +5V.
	3	DV	DTMF signal detector.
	4	VOB	DRS unit VOB output.
	5	VOA	DRS unit VOA output.
	6	RD	DRS unit RD output.
	7	WR	DRS unit WR output.
	8	ACL	DRS unit RESET output ($\overline{ACL}$).
	9	STBY	DRS unit STBY output.
	10	OE	DRS OE, DTSS EN.
CN205	1	DT	LCD driver data output.
	2	CK	LCD driver clock output.
	3	CE	LCD driver enable output.
	4	C5	+5V.
	5	E	GND.
	6	FC	Function control.
	7	NC	
	8	F.LAMP	Function lamp B.
	9	LAMP	Lamp B.
W201	1	GND	GND.
	2	RD	CTCSS unit voice de-modulation input.
	3	C5	Common +5V.
	4	DET	CTCSS unit tone matching input.
	5	CTC	CTCSS unit clock output.
	6	CTD	CTCSS unit data output.
	7	CTS	CTCSS unit enable output.

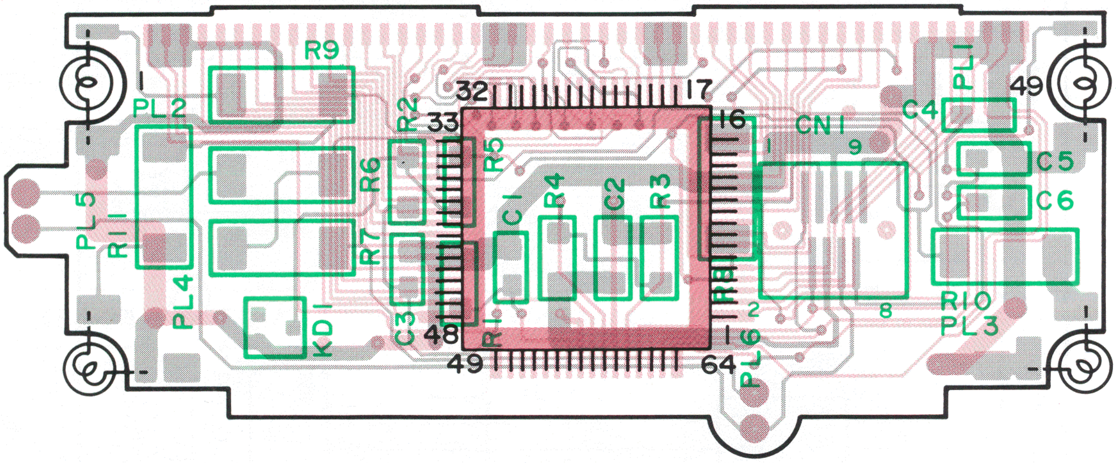
CIRCUIT DIAGRAM / PC BOARD VIEW TM-241A/E

LCD ASS'Y (B38-0330-05)

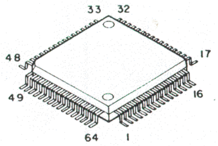

IC1
LCD1
LCD HOLDER
A LOCK
REV
+
AL
CTCSS
DTSS
DRS
APO
F
BUSY
S & RF
1
3
5
7
9
OVER
ON AIR
LOWMIDT
S1 … S53
COM0
COM1
COM2
OSC
VDD
INH
VLCD
VSS
CE
CLK
DATE
R1
R2
R3
R4
R5
R6
R8
R9
R10
R11
C1
C2
C3
C4
C5
C6
D1
PL1
PL2
PL3
PL4
PL5
PL6
CN1
1
9
DT
CK
CE
5C
E
FC
NC
F.LAMP
LAMP

IC1 : LC7582
D1 : 02CZ5.1Y

LCD ASS'Y (B38-0330-05) Component side view

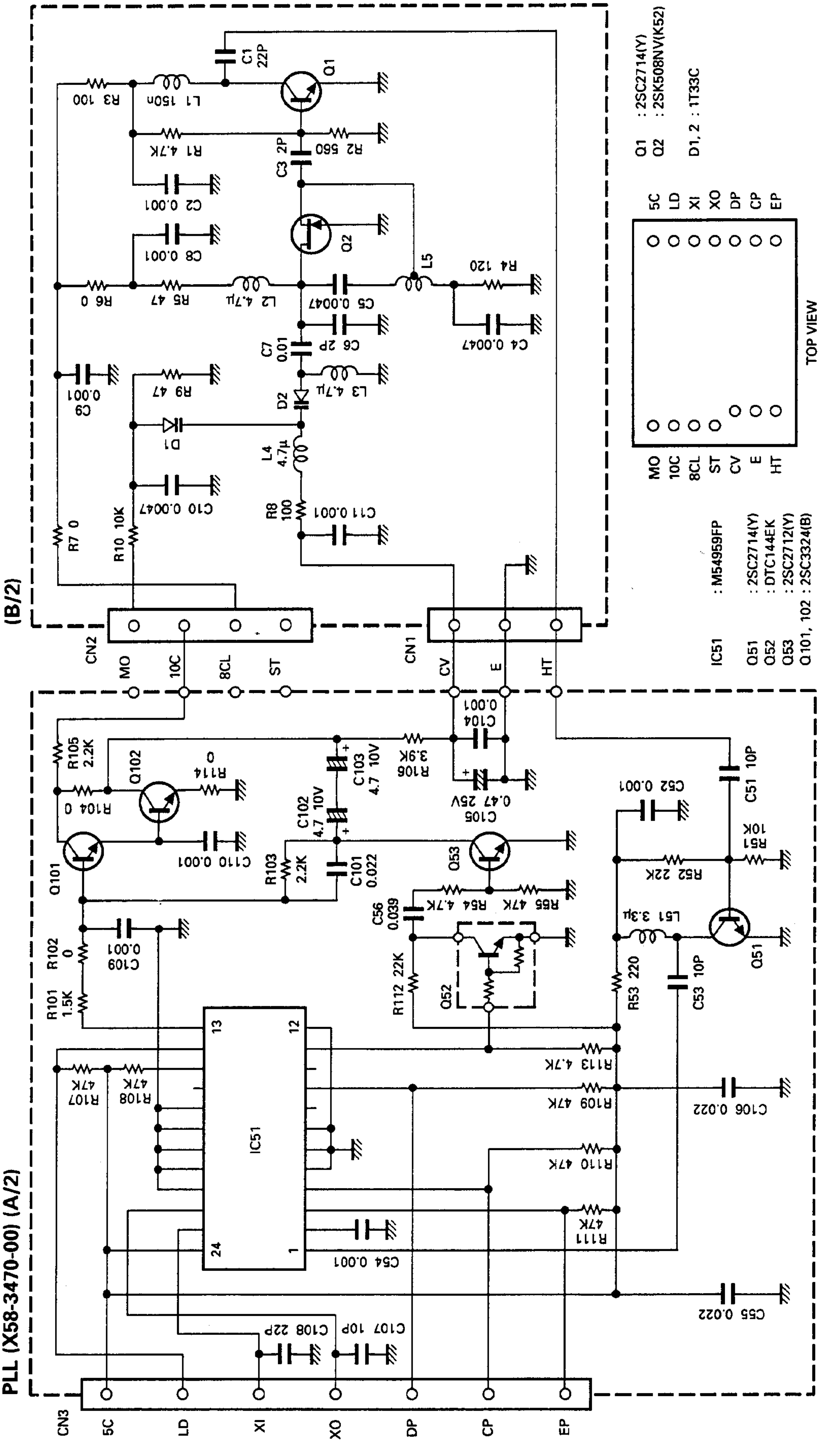

R9
PL2
PL5
R11
PL4
R6
R7
KD1
R2
C3
33
32
17
16
48
49
64
R5
C1
R4
C2
R3
R1
R8
CN1
1
9
2
8
PL6
C4
PL1
49
C5
C6
R10
PL3

LC7582


33
32
48
17
49
16
64
1

TM-241A/E CIRCUIT DIAGRAM / PC BOARD VIEWS

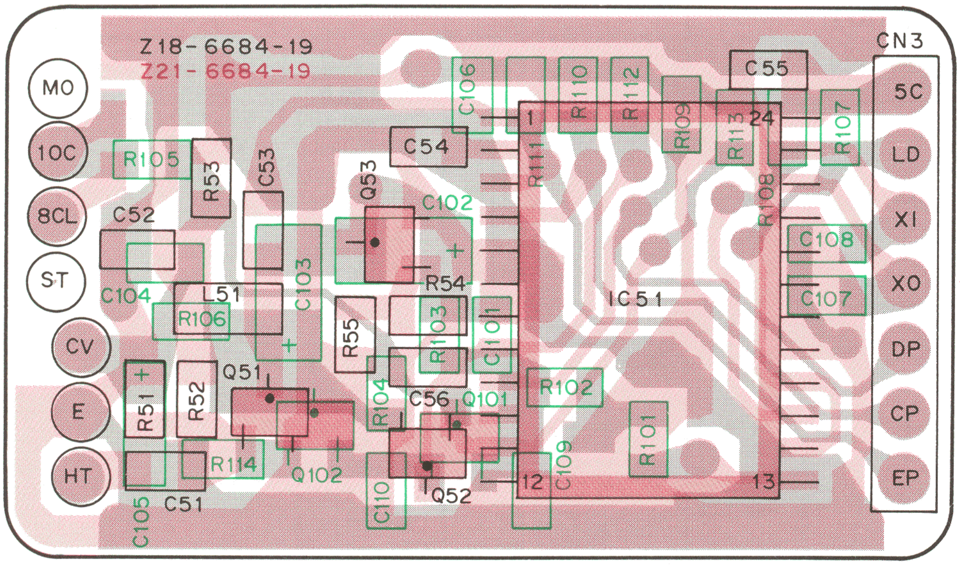
PLL (X58-3470-00) : K,P,X,M,M2,M3,E,E2,E9,EM


(B/2)
PLL (X58-3470-00) (A/2)
C1 22P
Q1
L1 150n
R3 100
R1 4.7K
R2 560
C3 2P
C2 0.001
C8 0.001
Q2
L5
R4 120
R6 0
R5 47
L2 4.7μ
C5 0.0047
C4 0.0047
C6 2P
C7 0.01
L3 4.7μ
C9 0.001
R9 47
D2
D1
L4 4.7μ
C10 0.0047
R8 100
C11 0.001
R7 0
R10 10K
CN2
MO
10C
8CL
ST
CN1
CV
E
HT
C104 0.001
R105 2.2K
R114 0
Q102
C103 4.7 10V
R106 3.9K
C105 0.47 25V
R104 0
C102 4.7 10V
C52 0.001
C51 10P
R51 10K
Q101
C110 0.001
R103 2.2K
C101 0.022
Q53
R52 22K
R54 4.7K
R55 47K
C56 0.039
L51 3.3μ
Q51
R102 0
C109 0.001
R101 1.5K
R112 22K
Q52
R53 220
C53 10P
13
12
IC51
24
1
R113 4.7K
R107 47K
R108 47K
R109 47K
C106 0.022
R110 47K
R111 47K
C54 0.001
C55 0.022
C108 22P
C107 10P
CN3
5C
LD
XI
XO
DP
CP
EP
TOP VIEW
5C
LD
XI
XO
DP
CP
EP
MO
10C
8CL
ST
CV
E
HT

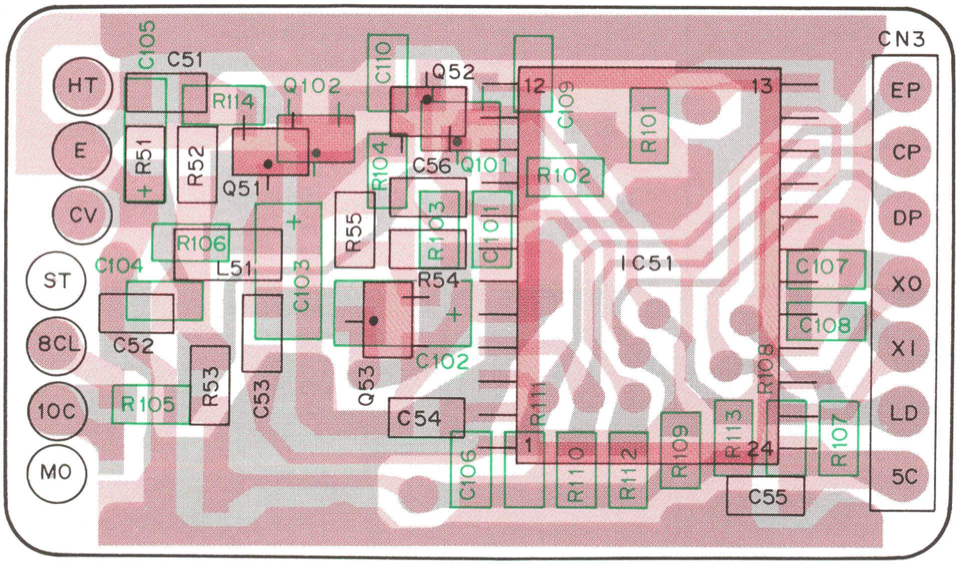
Q1 : 2SC2714(Y)
Q2 : 2SK508NV(K52)
D1, 2 : 1T33C

IC51 : M54959FP
Q51 : 2SC2714(Y)
Q52 : DTC144EK
Q53 : 2SC2712(Y)
Q101, 102 : 2SC3324(B)

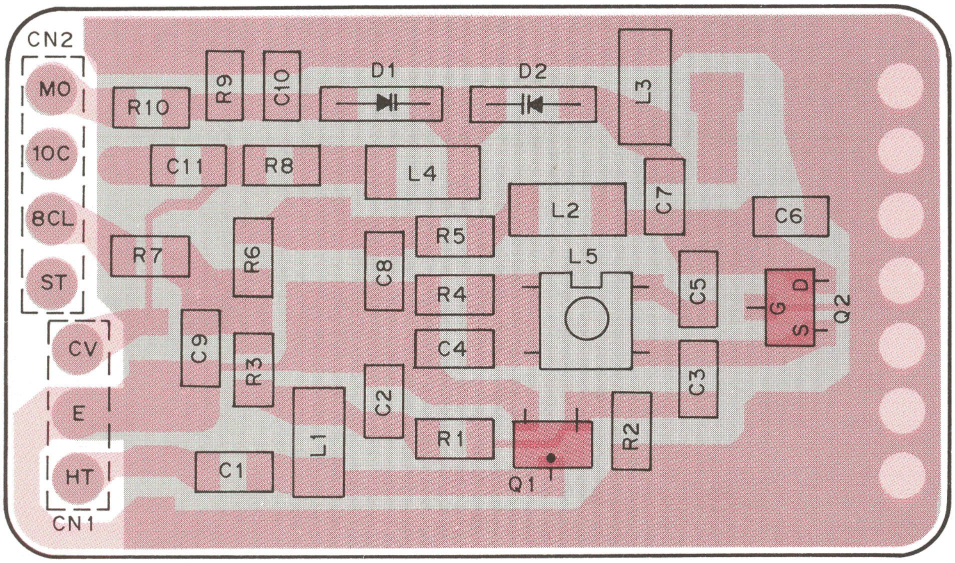
PLL (X58-3470-00) (A/2) Component side view


Z18-6684-19
Z21-6684-19
MO
10C
8CL
ST
CV
E
HT
CN3
5C
LD
XI
XO
DP
CP
EP
R105
R53
C53
C52
C104
L51
R106
C103
Q53
C102
R54
C54
C106
R111
R110
R112
R109
R113
R108
R107
C55
C108
C107
IC51
1
24
12
13
R55
R103
C101
R104
C56
Q101
R102
R101
C109
C110
Q52
Q51
R51
R52
R114
Q102
C105
C51

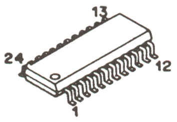
PLL (X58-3470-00) (A/2) Foil side view


HT
E
CV
ST
8CL
10C
MO
CN3
EP
CP
DP
XO
XI
LD
5C
C105
C51
R114
Q102
R51
R52
Q51
C110
Q52
R104
C56
Q101
R102
R101
C109
12
13
R106
C104
L51
C103
R55
R103
C101
IC51
C107
C108
R54
C52
Q53
C102
R53
R105
C53
C54
R111
R108
1
24
C106
R110
R112
R109
R113
R107
C55

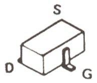
PLL (X58-3470-00) (B/2) Component side view


CN2
MO
10C
8CL
ST
CV
E
HT
CN1
R10
R9
C10
D1
D2
L3
C11
R8
L4
L2
C7
C6
R7
R6
R5
L5
C8
R4
C5
G
D
S
Q2
C9
R3
C4
C3
C2
L1
R1
R2
C1
Q1

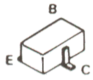
M54959FP



2SK508NV

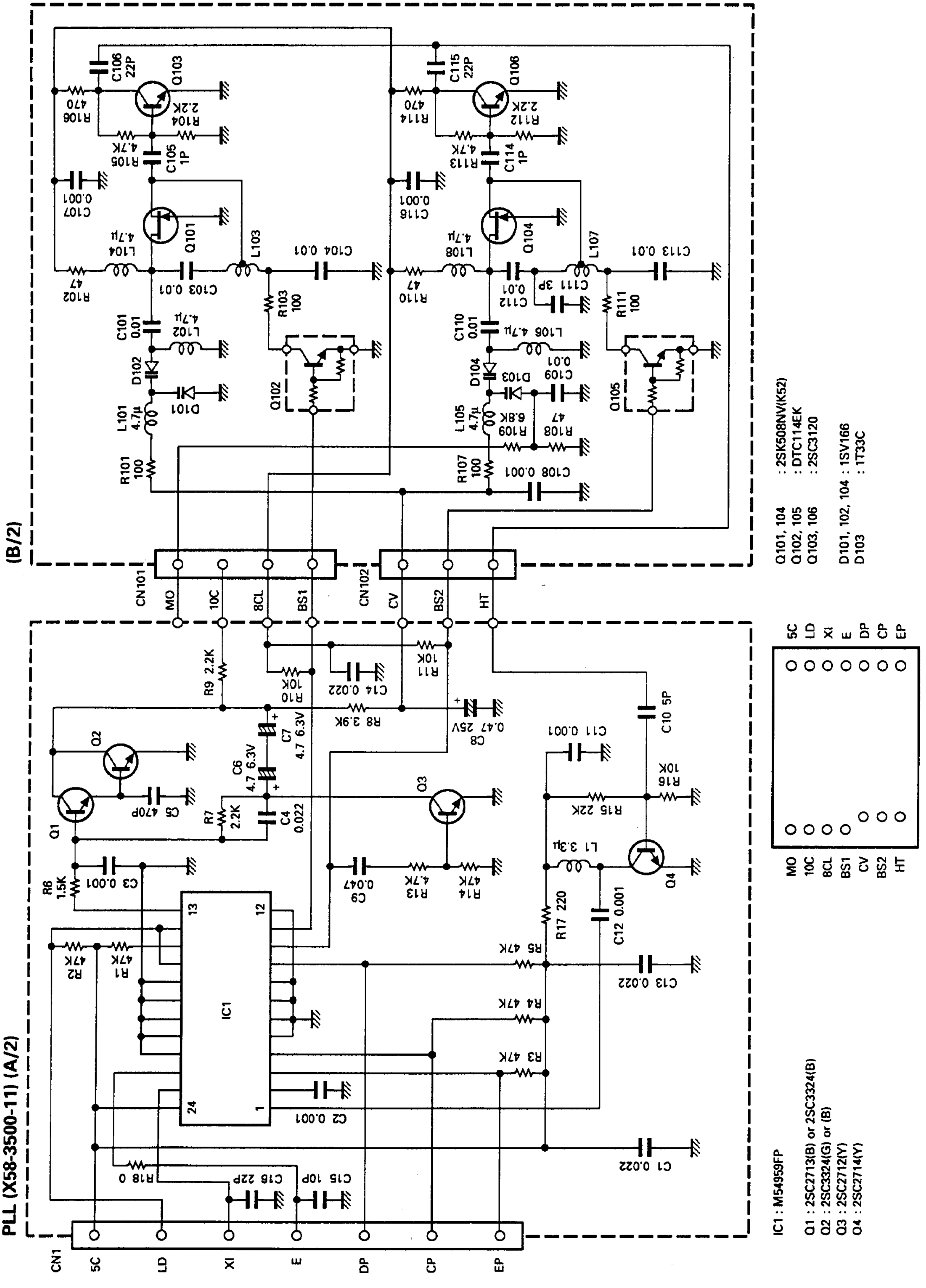


2SC2712
2SC2714
2SC3324
DTC144EK

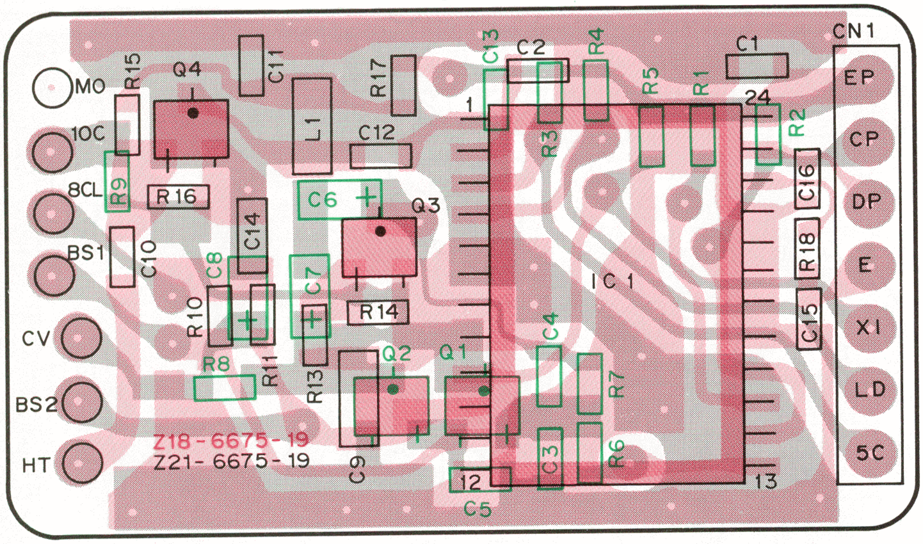


▨ : Component side
▨ : Foil side

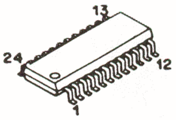
PLL (X58-3500-11) : K2,P2


(B/2)
PLL (X58-3500-11) (A/2)
Q101, 104 : 2SK508NV(K52)
Q102, 105 : DTC114EK
Q103, 106 : 2SC3120
D101, 102, 104 : 1SV166
D103 : 1T33C
IC1 : M54959FP
Q1 : 2SC2713(B) or 2SC3324(B)
Q2 : 2SC3324(G) or (B)
Q3 : 2SC2712(Y)
Q4 : 2SC2714(Y)
TOP VIEW
5C
LD
XI
E
DP
CP
EP
MO
10C
8CL
BS1
CV
BS2
HT
CN101
CN102
CN1
C106 22P
Q103
R106 470
R104 2.2K
R105 4.7K
C105 1P
C107 0.001
L104 4.7μ
Q101
L103
C104 0.01
R102 47
C103 0.01
R103 100
C101 0.01
L102 4.7μ
D102
D101
Q102
L101 4.7μ
R101 100
C115 22P
Q106
R114 470
R112 2.2K
R113 4.7K
C114 1P
C116 0.001
L108 4.7μ
Q104
L107
C113 0.01
R110 47
C112 0.01
C111 3P
R111 100
C110 0.01
L106 4.7μ
D104
D103
C109 0.01
Q105
L105 4.7μ
R109 6.8K
R108 47
R107 100
C108 0.001
R9 2.2K
R10 10K
C14 0.022
R11 10K
R8 3.9K
C8 0.47 25V
C7 4.7 6.3V
C6 4.7 6.3V
Q2
Q1
C5 470P
R7 2.2K
C4 0.022
Q3
C10 5P
C11 0.001
R16 10K
R15 22K
L1 3.3μ
Q4
R6 1.5K
C3 0.001
C9 0.047
R13 4.7K
R14 47K
R17 220
C12 0.001
IC1
13
12
24
1
R2 47K
R1 47K
R5 47K
C13 0.022
R4 47K
R3 47K
C2 0.001
C1 0.022
R18 0
C16 22P
C15 10P

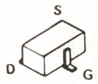
PLL (X58-3500-11) (A/2) Component side view


MO
10C
8CL
BS1
CV
BS2
HT
R15
Q4
R9
R16
C10
C11
L1
R17
C12
C6
Q3
C14
C8
R10
C7
R14
R8
R11
R13
Q2
Q1
C9
Z18-6675-19
Z21-6675-19
C13
C2
R4
R5
R1
C1
R3
R2
1
24
IC 1
C16
R18
C15
C4
R7
C3
R6
12
13
C5
CN1
EP
CP
DP
E
XI
LD
5C

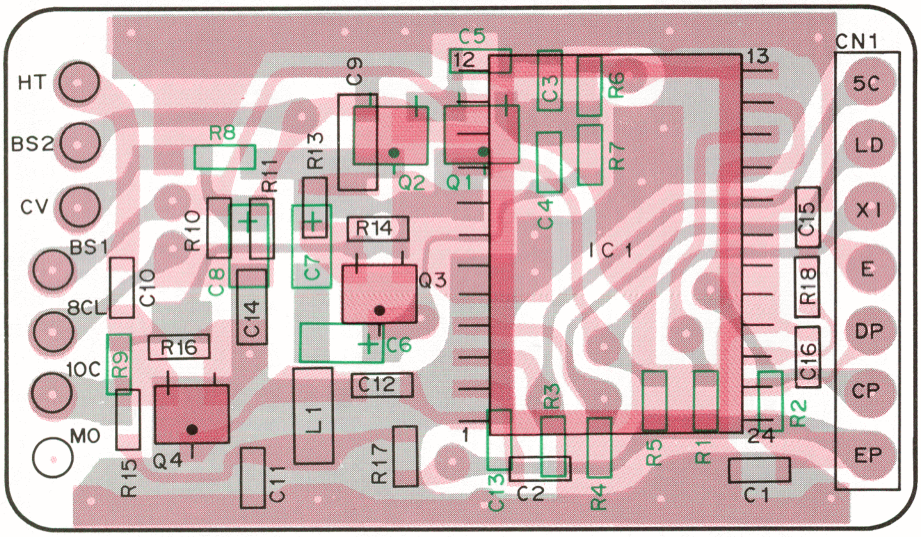
M54959FP



2SK508NV

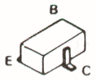


PLL (X58-3500-11) (A/2) Foil side view

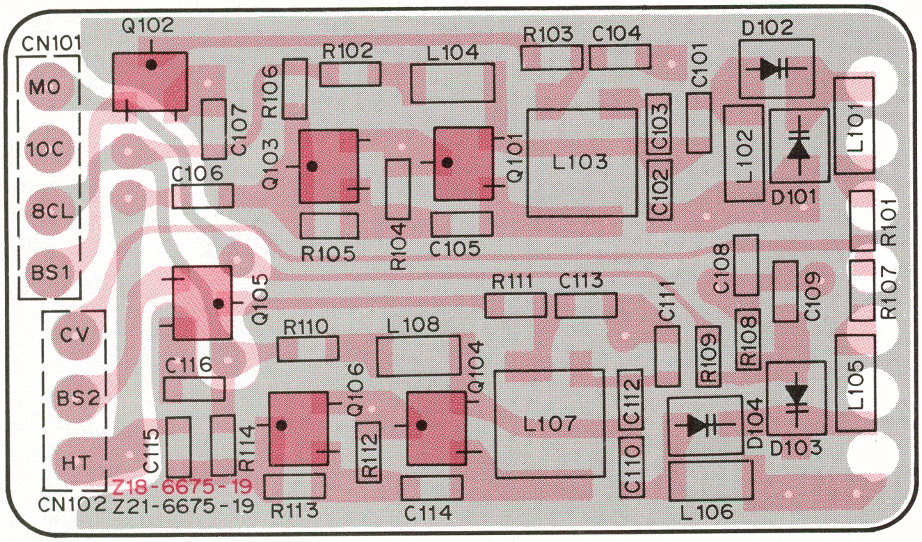

HT
BS2
CV
BS1
8CL
10C
MO
C5
12
C9
R8
R13
Q2
Q1
C3
R6
R7
13
CN1
5C
LD
XI
E
DP
CP
EP
R11
R10
C8
C7
R14
Q3
C10
C14
C6
IC 1
C4
C15
R18
C16
R16
R9
C12
Q4
R15
L1
C11
R17
1
C13
C2
R3
R4
R5
R1
24
R2
C1

2SC2712
2SC2713
2SC2714

2SC3120
2SC3324
DTC114EK

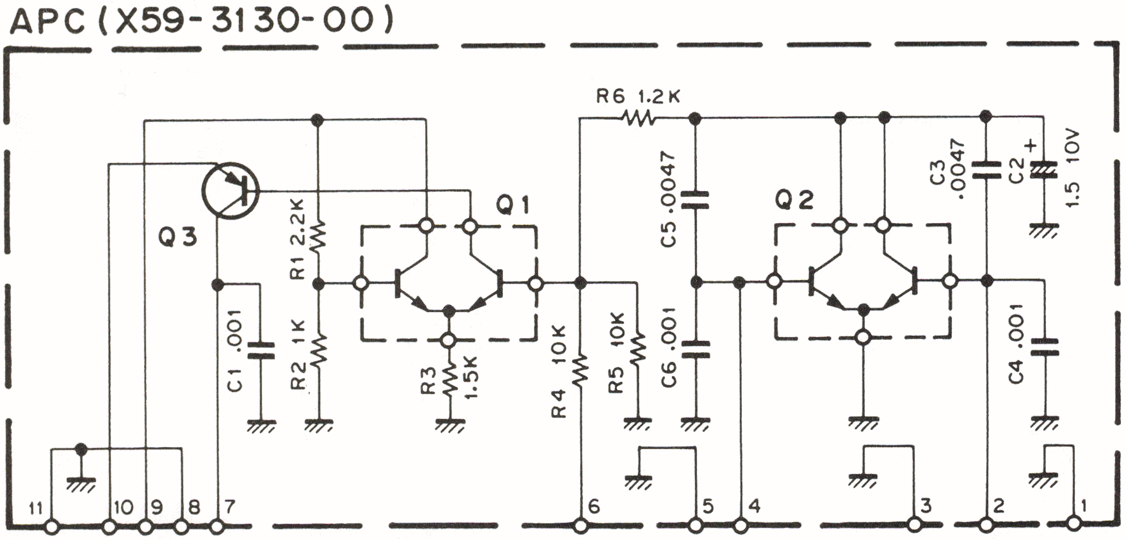


PLL (X58-3500-11) (B/2) Component side view


CN101
MO
10C
8CL
BS1
CV
BS2
HT
CN102
Q102
R102
L104
R103
C104
D102
C101
R106
C107
Q103
C106
R105
R104
C105
Q101
L103
C103
C102
L102
L101
D101
R101
R107
C108
C109
R108
R109
C111
R111
C113
Q105
R110
L108
C116
Q106
Q104
L107
C112
C110
D104
D103
L105
C115
R114
R112
R113
C114
L106
Z18-6675-19
Z21-6675-19

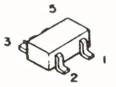
▨ : Component side
▨ : Foil side

APC (X59-3130-00)

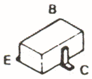

APC (X59-3130-00)
R6 1.2K
C5 .0047
C3 .0047
C2 1.5 10V
Q3
Q1
Q2
R1 2.2K
R2 1K
C1 .001
R3 1.5K
R4 10K
R5 10K
C6 .001
C4 .001
11
10
9
8
7
6
5
4
3
2
1

Q1, 2 : FMW1 Q3 : 2SA1162 (Y)

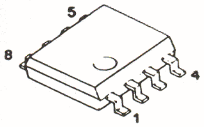
FMW1



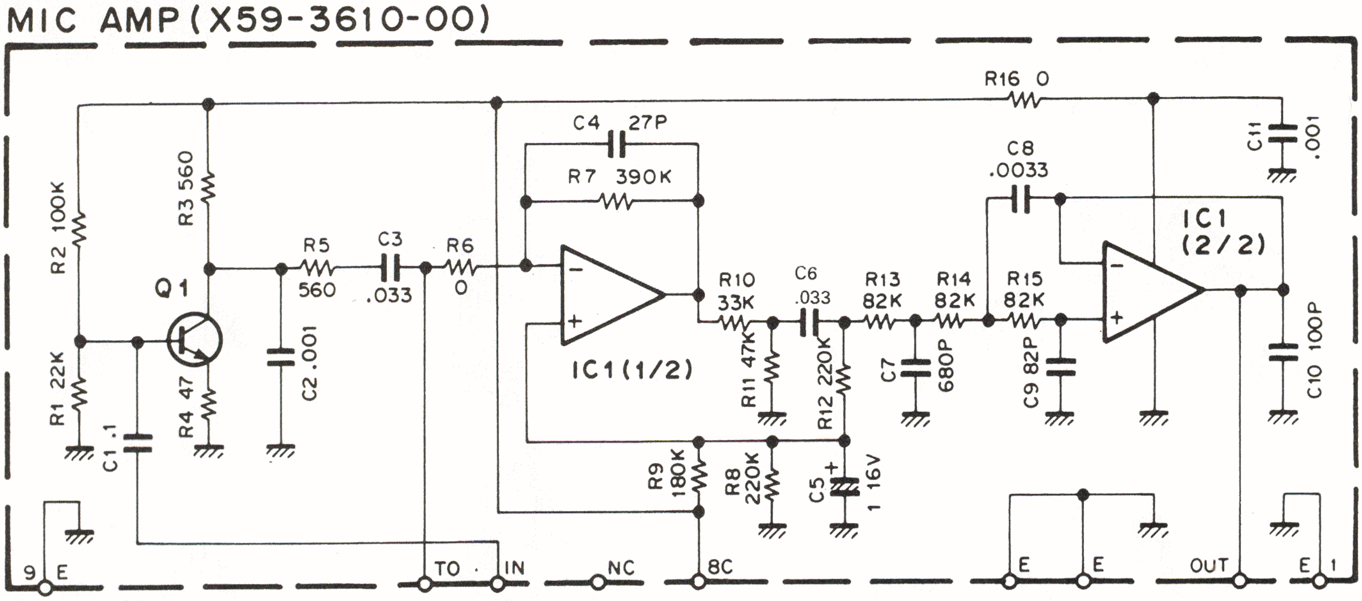
2SA1162
2SC4116



NJM4558M

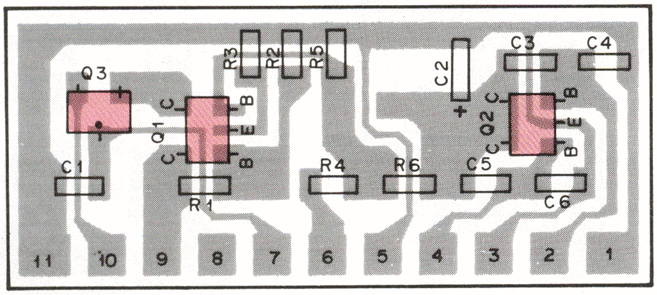


MIC AMP (X59-3610-00)

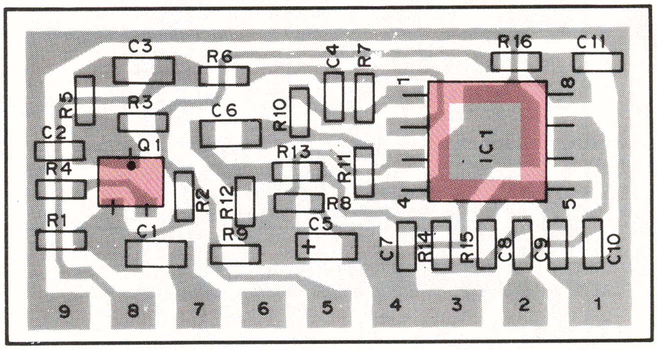

MIC AMP (X59-3610-00)
R16 0
C11 .001
C4 27P
R7 390K
C8 .0033
IC1 (2/2)
R3 560
R2 100K
R5 560
C3 .033
R6 0
Q1
R10 33K
C6 .033
R13 82K
R14 82K
R15 82K
C10 100P
R1 22K
R4 47
C2 .001
IC1 (1/2)
R11 47K
R12 220K
C7 680P
C9 82P
C1 .1
R9 180K
R8 220K
C5 1 16V
9 E
TO
IN
NC
8C
E
E
OUT
E 1

Q1 : 2SC4116 (GR) IC1 : NJM4558M

APC (X59-3130-00) Foil side view


Q3
R3
R2
R5
C2
C3
C4
Q1
C
B
E
Q2
C1
R1
R4
R6
C5
C6
11
10
9
8
7
6
5
4
3
2
1

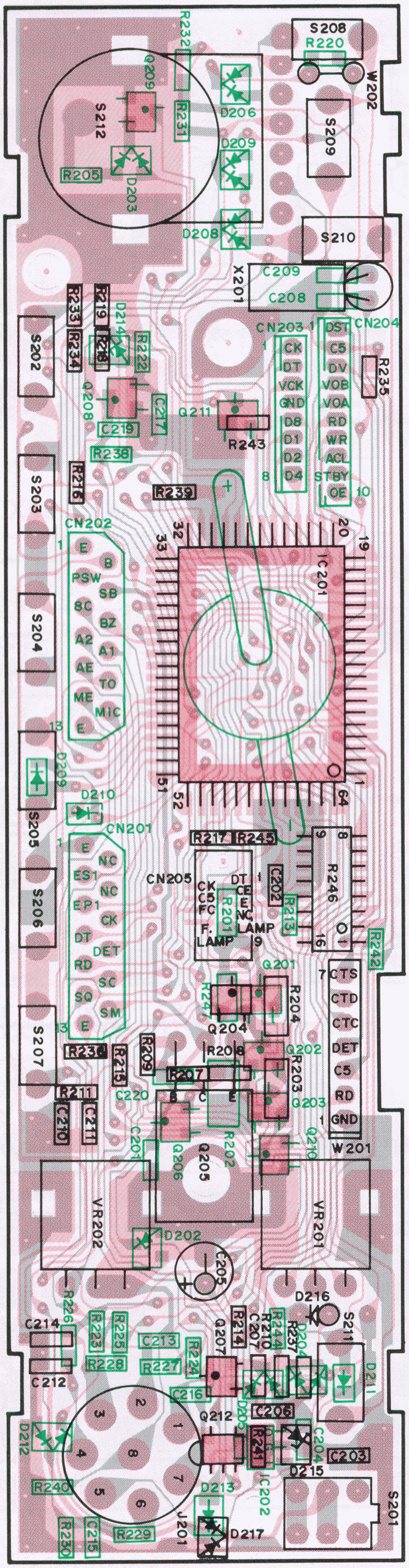
MIC AMP (X59-3610-00) Foil side view


C3
R6
C4
R7
R16
C11
R5
R3
C6
R10
IC1
C2
Q1
R13
R11
R4
R2
R12
R8
R1
C1
R9
C5
C7
R14
R15
C8
C9
C10
1
8
4
5
9
8
7
6
5
4
3
2
1

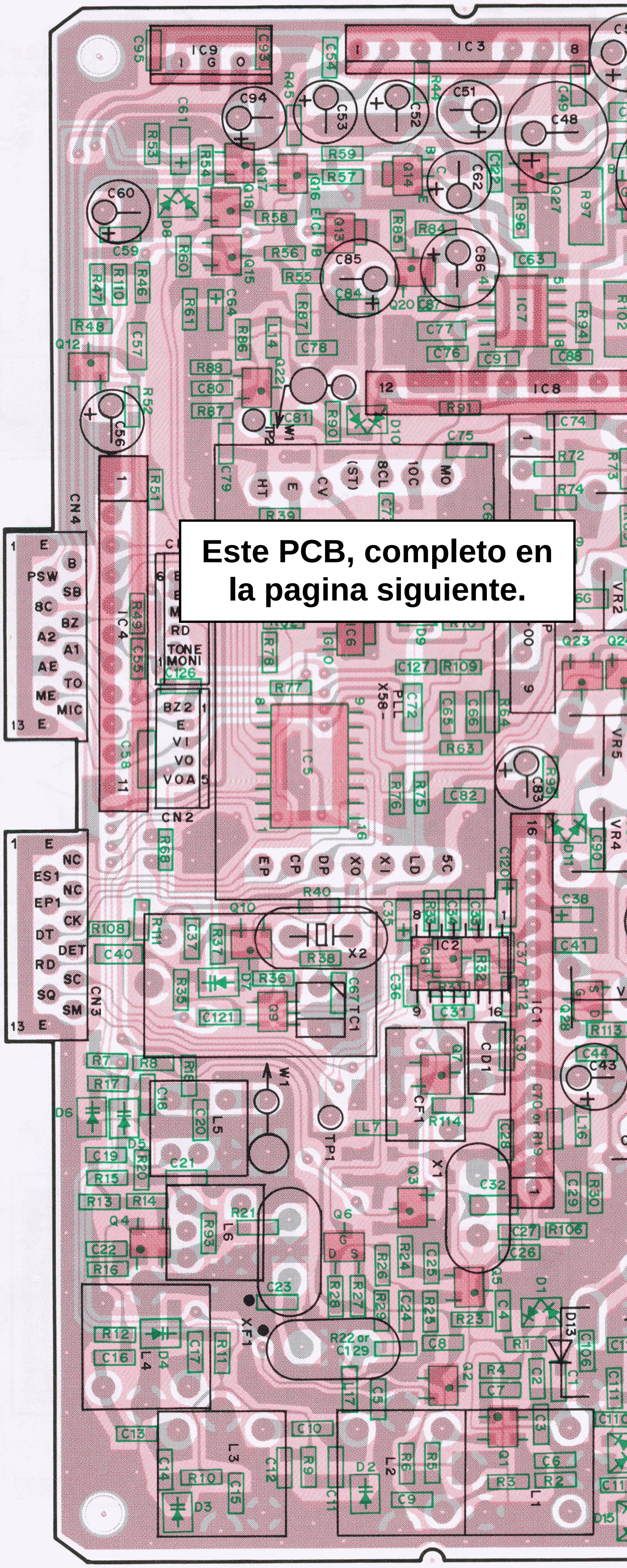
TM-241A/E **PC BOARD VIEWS**

TX-RX UNIT (X57-369X-XX) Component side view

0-11 : K,P,X 0-12 : K2,P2 0-21 : M 0-22 : M2,M3 2-71 : E,E9,EM 2-72 : E2



S208
R220
W202
S209
S210
S212
Q209
R231
D206
D209
D203
D208
R205
R232
X201
C209
C208
CN204
CN203
S202
S203
S204
S205
S206
S207
R233
R219
R234
R218
D214
R222
Q208
C217
C219
Q211
R243
R235
R238
R216
R239
CN202
IC201
D209
D210
CN201
CN205
R217
R245
C202
R213
R246
R242
R201
Q201
R204
Q204
R247
R208
Q202
R203
Q203
R236
R215
R209
R207
R211
C210
C211
C220
C201
Q206
Q205
R202
Q210
W201
VR202
VR201
D202
C205
D216
S211
R226
C214
C212
R225
R223
R228
C213
R227
R224
Q207
R214
R210
C207
R244
R237
D204
D211
C216
Q212
C206
D205
R241
C204
C203
D215
D212
R240
D213
IC202
J201
D217
S201
R230
C215
R229



C95
IC9
C93
C54
IC3
C49
C48
C94
R45
C53
C52
C51
C61
R53
R54
Q17
Q16
R59
R57
Q14
C62
C122
Q27
R96
R97
C60
D8
Q18
Q13
R58
R85
R84
C85
C86
C59
R60
Q15
R56
R55
C84
C63
R47
R110
R46
R61
C64
Q20
C87
IC7
R102
R48
R86
R87
C77
R94
Q12
C57
L14
C78
C76
C91
C88
R88
Q22
C80
R87
R52
C56
C81
R90
D10
IC8
R91
C74
C75
R72
R73
R74
CN4
C79
R51
R39
IC4
R49
C55
C58
CN2
IC6
R78
R77
D9
C127
R109
X58-
PLL
IC5
C72
C65
C66
R64
R63
Q23
VR2
VR5
R95
C83
R76
R75
C82
R68
D11
C90
VR4
CN3
R40
Q10
X2
R108
R111
C37
R37
R36
C40
R35
D7
C67
TC1
IC2
R32
C36
C35
C121
Q9
C31
IC1
R112
C30
R113
C44
C43
R7
R8
R6
W1
CD1
R17
C18
C20
L5
TP1
L7
CF1
R114
C70
R19
L16
D6
D5
C19
R20
C21
X1
Q3
R15
C32
C29
R30
R13
R14
R21
R93
L6
Q6
C27
R106
C26
Q4
C22
R16
R24
C25
C23
R26
R27
R28
R29
C24
R25
R23
C4
D1
D13
R12
D4
C17
R11
XF1
R22
C129
C8
R1
C106
C16
L4
Q2
R4
C7
C2
C1
C11
L3
L2
R6
R5
Q1
C3
C13
C10
C12
R9
C14
R10
C15
D2
C6
R2
R3
C9
D3
L1
D15

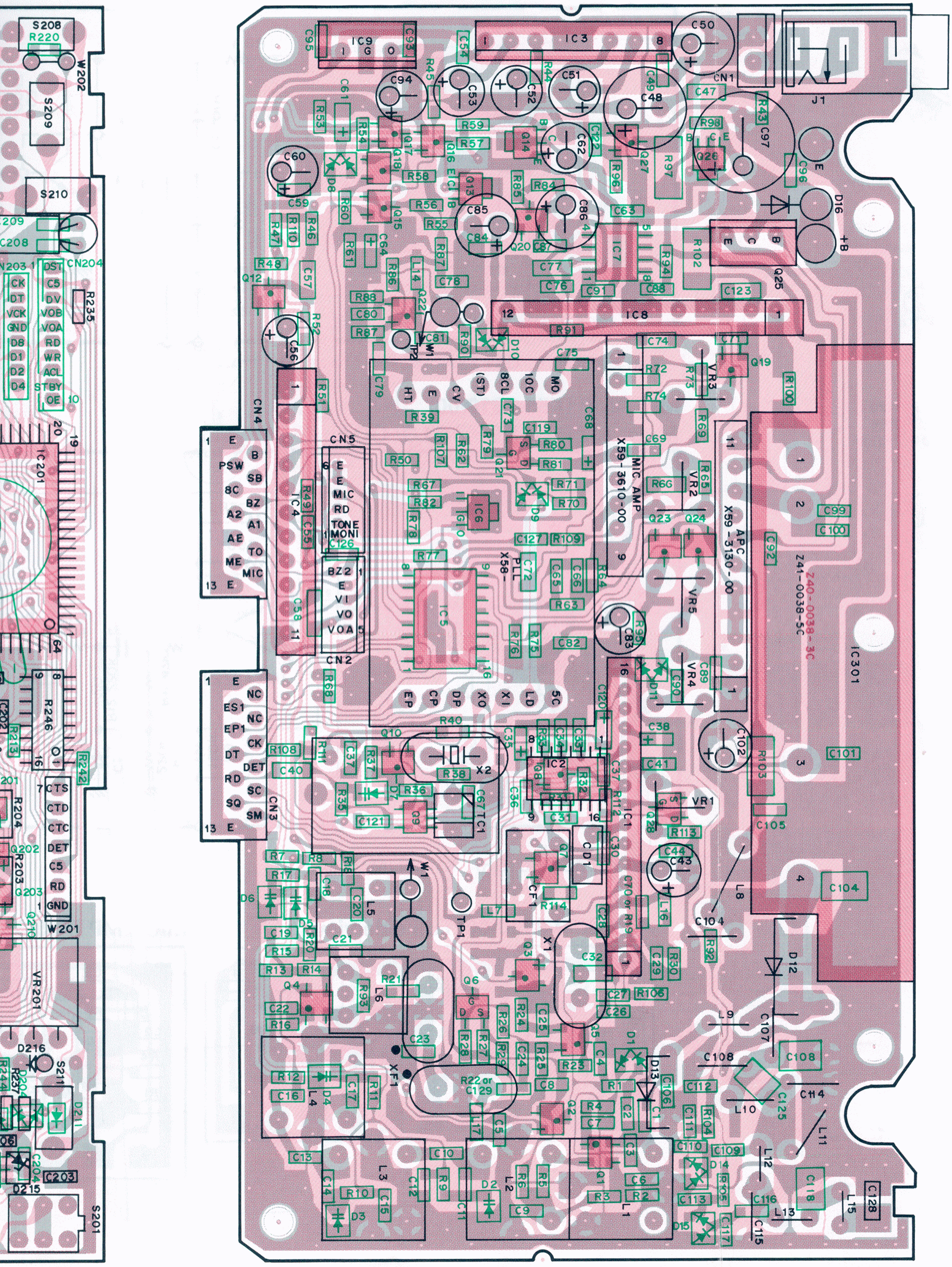
Este PCB, completo en la pagina siguiente.

E PC BOARD VIEWS

Cont. de la página 44

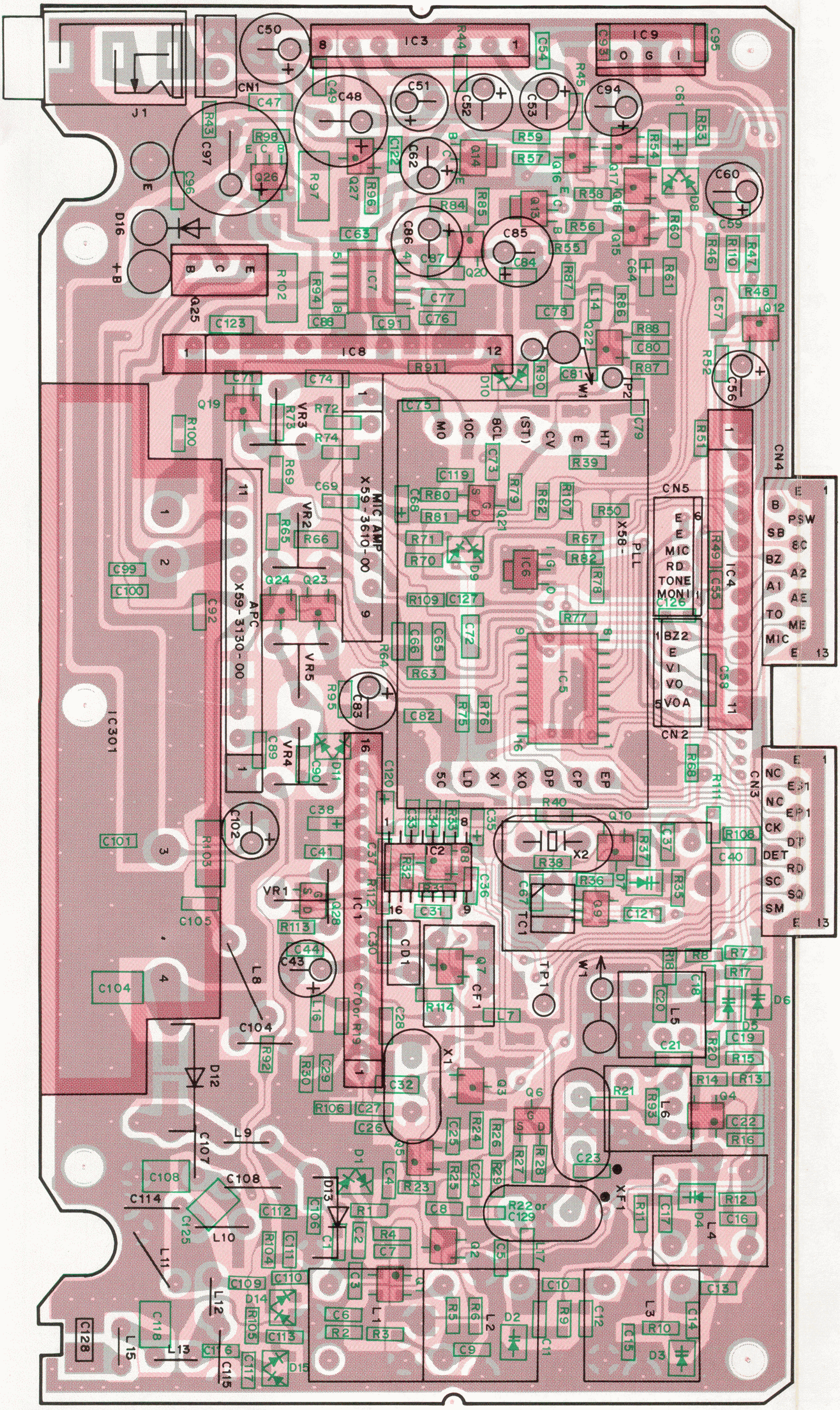
59X-XX) Component side view

K2,P2 0-21 : M 0-22 : M2,M3 2-71 : E,E9,EM 2-72 : E2


S208
R220
W202
S209
S210
C209
C208
CN203
CN204
R235
IC201
R246
R213
R242
R204
Q202
R203
Q203
Q210
W201
VR201
D216
S211
D211
D215
C203
S201
IC9
IC3
C50
CN1
J1
C94
C53
C52
C51
C48
C47
C97
C60
D8
Q17
Q18
Q16
Q13
Q14
C62
Q27
Q26
D16
C85
C86
Q20
IC7
R102
Q25
+B
C123
Q12
C56
Q22
TP2
W1
D10
IC8
C74
C71
Q19
R100
CN4
PSW
SB
BZ
A2
A1
AE
TO
ME
MIC
IC4
CN5
TONE
MONI
CN2
BZ2
VI
VO
VOA
HT
CV
(ST)
8CL
10C
MO
Q21
IC6
D9
X58-
PLL
IC5
X59-3610-00
MIC AMP
VR2
VR3
Q23
Q24
VR5
VR4
D11
X59-3130-00
APC
Z41-0038-5C
Z40-0038-3C
IC301
C99
C100
C101
C104
CN3
ES1
EP1
DT
RD
SQ
CK
DET
SC
SM
EP
CP
DP
XO
XI
LD
5C
R40
Q10
X2
IC2
IC1
Q7
Q9
TC1
VR1
Q28
CD1
CF1
X1
TP1
L5
L6
L7
L8
Q3
Q4
Q5
Q6
XF1
D1
D13
D12
L9
C107
C108
L10
C114
L11
L12
L13
L15
C128
Q2
Q1
L1
L2
L3
L4
D2
D3
D4
D5
D6
D7
D14
D15
R22 or C129
C70 or R19

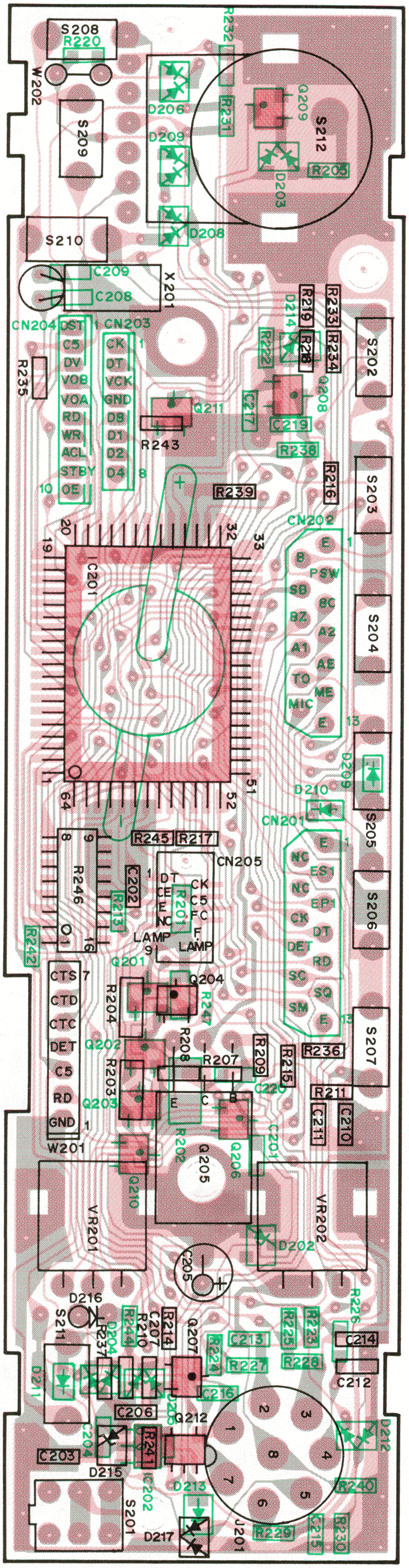
TX-RX UNIT (X57-369X-XX) Foil side view

0-11 : K,P,X 0-12 : K2,P2 0-21 : M 0-22 : M2,M3 2-71 : E,E9,EM 2-72 : E2

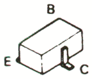

J1
CN1
C47
C50
IC3
R44
C54
IC9
O G I
C93
C95
R45
C48
C49
C51
C52
C53
C94
C61
R53
R43
C97
R98
Q26
C96
R97
Q27
R96
C122
C62
Q14
R59
R57
Q16
Q17
R54
D8
C60
D16
+B
R84
R85
Q13
R58
Q18
R60
C63
C86
C85
R56
R55
Q15
C59
R46
R110
R47
IC7
C87
Q20
C84
R87
C64
R61
Q25
R102
R94
C77
C76
C78
L14
R86
R48
Q12
C123
C88
C91
R88
C80
Q22
R87
C57
R52
IC8
R91
D10
R90
C81
W1
TP2
C56
C71
C74
Q19
R100
VR3
R73
R72
R74
C75
M0
10C
BCL
(ST)
CV
E
HT
C79
R51
CN4
C73
C119
R39
R69
MIC AMP
X59-3610-00
C69
C68
R80
R81
R79
Q21
R62
R107
R50
CN5
E
E
MIC
RD
TONE
MONI
X58-
PLL
IC4
R49
C55
E 1
B PSW
SB 8C
BZ A2
A1 AE
TO ME
MIC
E 13
VR2
R65
R66
R71
R70
D9
IC6
R67
R82
R78
C126
C99
C100
C92
APC
X59-3130-00
Q24
Q23
R109
C127
C72
R77
IC5
1BZ2
E
VI
VO
5VOA
CN2
C58
VR5
R64
C66
C65
R63
C83
R95
C82
R75
R76
IC301
C89
VR4
C90
D11
C120
5C
LD
XI
XO
DP
CP
EP
R68
R111
CN3
E 1
NC ES1
NC EP1
CK DT
DET RD
SC SQ
SM E 13
C102
R103
C101
C38
C41
C33
C34
R33
C35
C37
IC2
R32
R31
C36
C31
R40
Q10
X2
R38
C67
TC1
R36
D7
R35
Q9
C121
C37
R108
C40
VR1
Q28
R113
C105
C43
C44
L16
IC1
R112
C30
CD1
Q7
CF1
R114
L7
TP1
W1
R18
R8
R7
R17
C18
C20
L5
D5
D6
C19
C21
R20
R15
C104
L8
C104
R92
R30
C29
C28
C70 or R19
X1
C32
Q3
Q6
R21
R93
L6
R14
R13
Q4
C22
R16
D12
R106
C27
C26
C25
R24
R26
R27
R28
C107
L9
Q5
D1
C4
R23
R25
C24
R29
C23
XF1
C108
C108
C114
C125
L10
D13
C112
C106
R1
C8
R22 or C129
R11
C17
D4
L4
R12
C16
L11
R104
C111
C1
C2
R4
C7
Q2
C5
L7
C109
C110
C3
Q1
C10
C12
C13
D14
R105
C6
L1
R5
R6
L2
D2
R9
L3
C14
R10
L12
C118
C113
R2
R3
C9
C11
C15
D3
C128
L15
L13
C116
C115
C117
D15

W202
CN204
R235
R242
D211

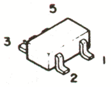
2-72 : E2


S208
R220
W202
S209
D206
D209
D208
R232
R231
Q209
S212
D203
R205
S210
C209
C208
X201
CN204
CN203
CST
C5
DV
VOB
VOA
RD
WR
ACL
STBY
OE
CK
DT
VCK
GND
D8
D1
D2
D4
R235
Q211
R243
R219
R233
R218
R234
D214
R222
Q208
C217
C219
R238
R216
R239
S202
S203
S204
S205
S206
S207
CN202
E
B
PSW
SB
BC
BZ
A2
A1
AE
TO
ME
MIC
IC201
D210
D209
CN201
NC
ES1
EP1
DET
SC
SQ
SM
R245
R217
CN205
R246
C202
R213
R201
CE
FC
LAMP
R242
Q201
Q204
R204
R247
CTS
CTD
CTC
Q202
R208
R207
R209
R215
R236
Q203
R203
C220
R211
C211
C210
W201
R202
Q205
Q206
IC201
Q210
VR201
VR202
D202
C205
D216
S211
R237
D204
R244
R210
C207
R214
Q207
C213
R224
R227
R225
R223
R228
R226
C214
C212
D211
C206
C216
R206
Q212
D212
C204
C203
R241
D215
IC202
D213
R240
S201
D217
R229
R215
R230
J201

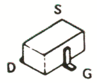
2SA1519
2SC2712
2SC2714
2SD1757K
DTA114YK
DTC114EK
DTC123JK
DTC124EK
DTC143EK
DTC144WK
DTD143EK



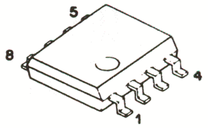
FMG2



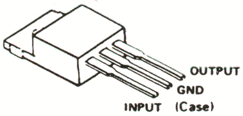
2SK208
2SJ106



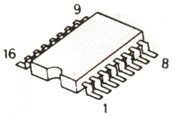
LA5010M



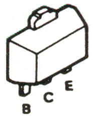
MC7808CT


OUTPUT
GND
INPUT
(Case)

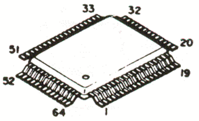
TA7787AF



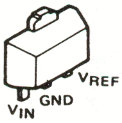
2SB1119
2SB1302



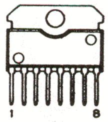
75116GF-E83-3BE
75116GF-J64-3BE


33
32
20
51
19
52
64
1

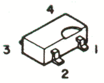
NJM78L05UA
NJM78L06UA


VREF
GND
VIN

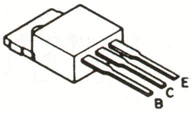
μPC1241H



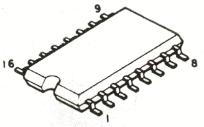
3SK131
3SK184



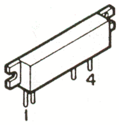
2SD1406
2SD1682



TC9174F

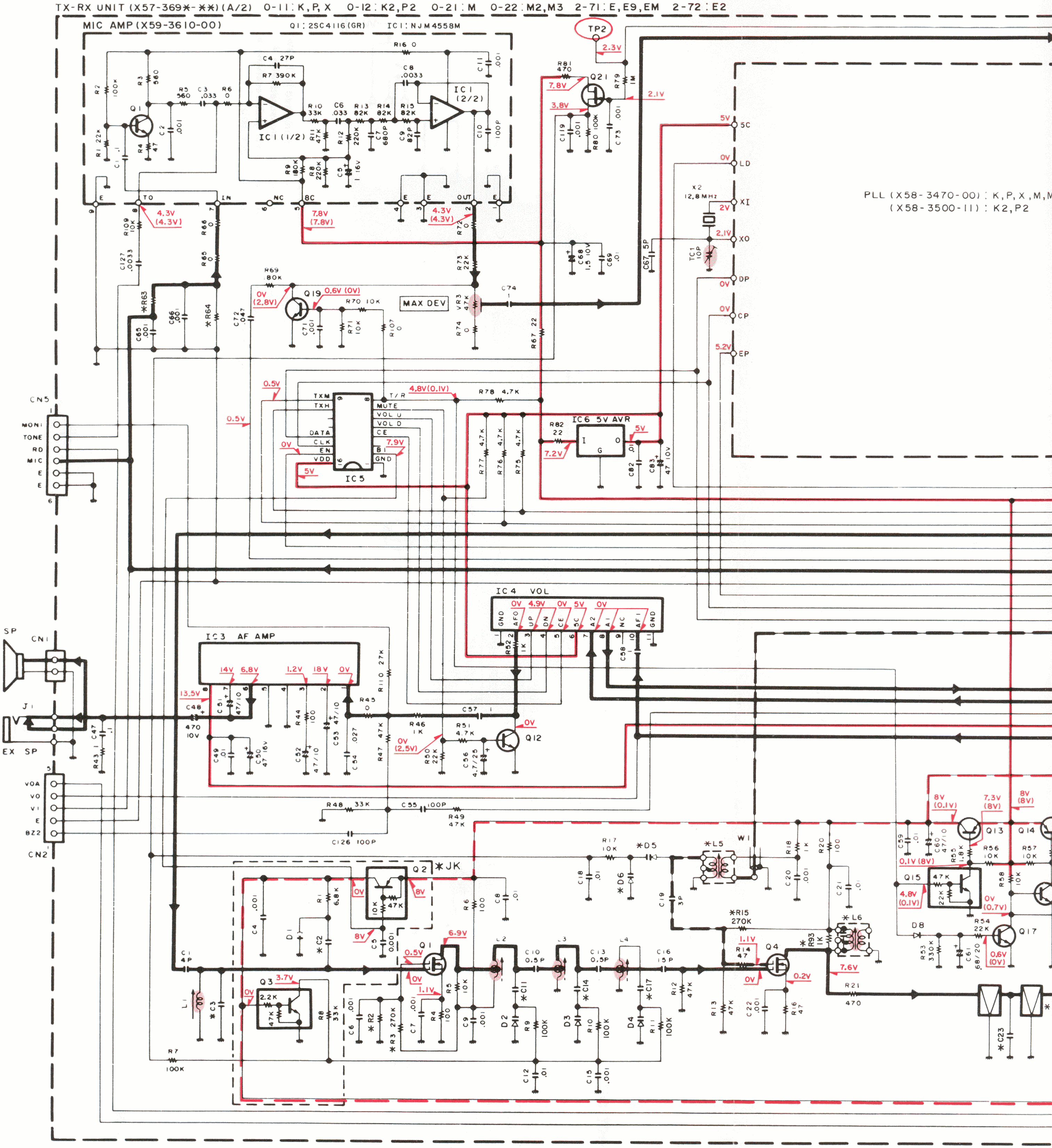


S-AV17



▨ : Component side
▩ : Foil side

Esquema TM241A/E (Part. 1 de 4)
Pagina 47


TX-RX UNIT (X57-369✱-✱✱)(A/2) 0-11 : K,P,X 0-12 : K2,P2 0-21 : M 0-22 : M2,M3 2-71 : E,E9,EM 2-72 : E2
MIC AMP (X59-3610-00)
Q1 : 2SC4116(GR) IC1 : NJM4558M
TP2
Q21
IC1 (1/2)
IC1 (2/2)
PLL (X58-3470-00) : K,P,X,M,M
(X58-3500-11) : K2,P2
5C
LD
XI
XO
DP
CP
EP
X2 12.8MHz
MAX DEV
Q19
IC5
IC6 5V AVR
CN5
MONI
TONE
RD
MIC
E
E
IC4 VOL
IC3 AF AMP
SP
CN1
J1
EX SP
CN2
VOA
VO
VI
E
8Z2
Q12
Q2 ✱JK
Q1
Q3
Q4
Q13
Q14
Q15
Q17
✱L5
✱L6
W1
✱D5
✱D6
✱R15 270K

	X57-369X-XX	IC201 75116GF-XXX-3BE	D5,6	D206	D207	D208	D209	D210	W202	C2	C3	C11,14,17	C23	C26	C28	C29	C32	C38	C70,129	L5 L34-XXXX-05	L6	L16,17	X1 (MHz)	XF1 (MHz)	R2	R3,15,19,22	R23	R3
TM-241A K,P,X	0-11	E83	1SV164	YES	NO	NO	NO	NO	YES	6P	4P	47P	5P	YES	33P	150P	YES	0.68/20V	NO	0956	L30-0005-05	NO	10.245	10.7	22K	YES	470	15
TM-241A K2,P2	0-12	J64	1SV166	YES	YES	YES	YES	NO	YES	5P	4P	68P	8P	NO	10P	0.001	YES	0.22/35V	YES	4113	L34-2157-05	YES	30.37	30.825	0	NO	1K	10
TM-241A M	0-21	E83	1SV164	YES	NO	NO	YES	NO	YES	NO	7P	47P	5P	YES	33P	150P	NO	0.68/20V	NO	0956	L30-0005-05	NO	10.245	10.7	22K	YES	470	15
TM-241A M2,M3	0-22	E83	1SV164	YES	YES	NO	YES	NO	NO	NO	7P	47P	5P	YES	33P	150P	NO	0.68/20V	NO	0956	L30-0005-05	NO	10.245	10.7	22K	YES	470	15
TM-241E E,E9,EM	2-71	E83	1SV164	YES	YES	NO	YES	YES	YES	NO	7P	47P	5P	YES	33P	150P	NO	0.68/20V	NO	0956	L30-0005-05	NO	10.245	10.7	22K	YES	470	15
TM-241E E2	2-72	E83	1SV164	NO	YES	NO	YES	YES	NO	NO	7P	47P	5P	YES	33P	150P	NO	0.68/20V	NO	0956	L30-0005-05	NO	10.245	10.7	22K	YES	470	15

Esquema TM241A/E (Part. 2 de 4)
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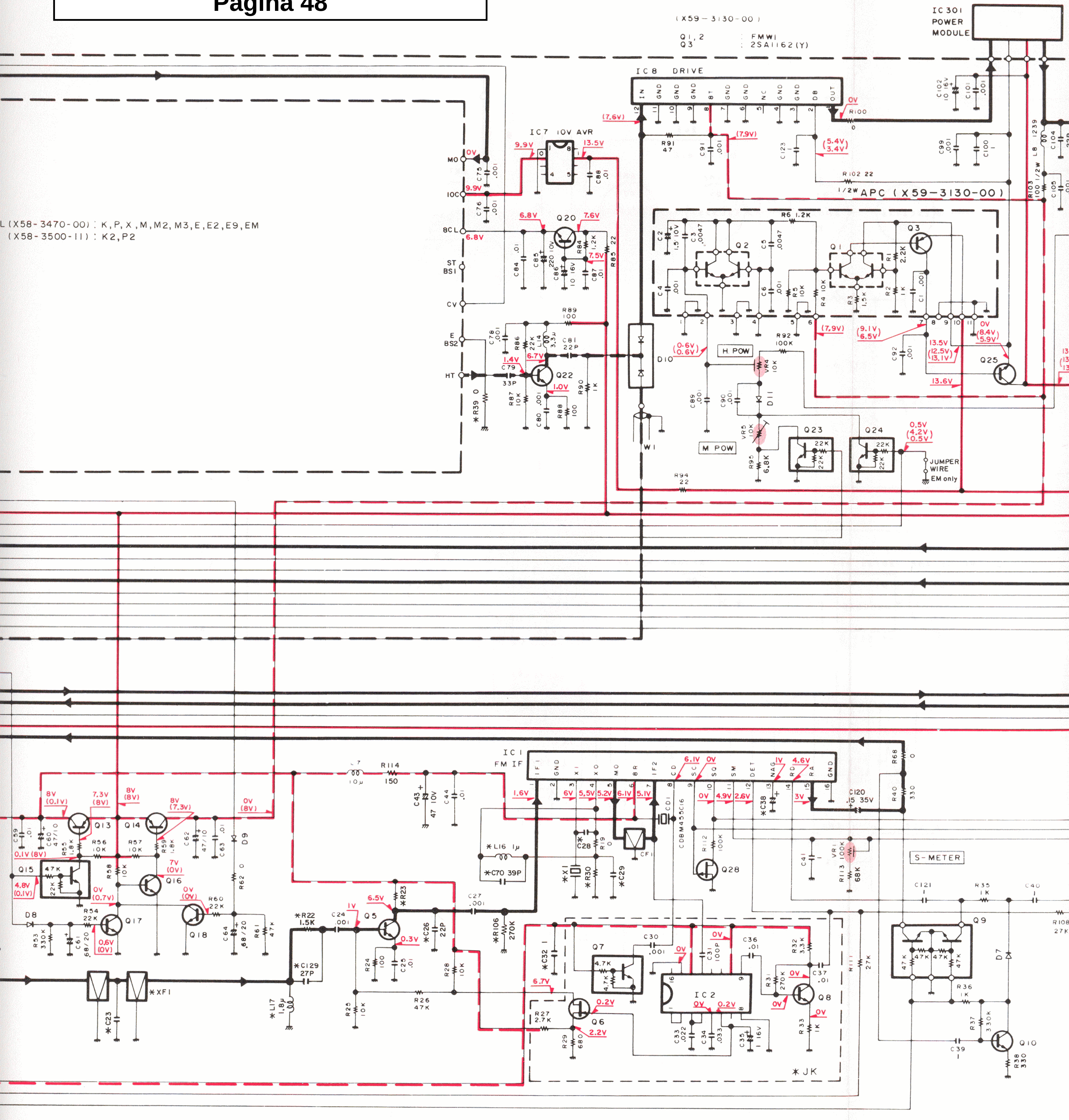


(X59-3130-00)
Q1, 2 : FMW1
Q3 : 2SA1162(Y)
IC301 POWER MODULE
IC8 DRIVE
IN GND GND BT GND GND NC GND GND DB OUT
IC7 10V AVR
APC (X59-3130-00)
L (X58-3470-00) : K, P, X, M, M2, M3, E, E2, E9, EM
(X58-3500-11) : K2, P2
MO
10C
8CL
ST BS1
CV
E BS2
HT
Q20
Q22
D10
W1
H POW
M POW
VR4
VR5
D11
Q23
Q24
Q25
Q1
Q2
Q3
JUMPER WIRE EM only
R94 22
IC1 FM IF
IF1 GND X1 XO MO BR IF2 CD SC SQ SM DET NAG RD RA GND
CF1
CDBM455C16
Q28
VR1
S-METER
Q9
Q10
D7
Q7
IC2
Q6
Q8
✱JK
Q5
Q13
Q14
Q15
Q16
Q17
Q18
D8
D9
✱XF1
✱L16 1μ
✱C70 39P
✱X1
✱L17 1.8μ
R114 150
C120 .15 35V

X1 Hz)	XF1 (MHz)	R2	R3,15,19,22	R23	R30	R39	R63	R64	R93	R106	R220	JK
.245	10.7	22K	YES	470	15K	YES	3.3K	3.9K	NO	YES	NO	YES
.37	30.825	0	NO	1K	10K	NO	3.3K	3.3K	YES	NO	NO	YES
.245	10.7	22K	YES	470	15K	YES	3.3K	3.9K	NO	YES	NO	NO
.245	10.7	22K	YES	470	15K	YES	3.3K	3.9K	NO	YES	YES	NO
.245	10.7	22K	YES	470	15K	YES	1K	56K	NO	YES	NO	NO
.245	10.7	22K	YES	470	15K	YES	1K	56K	NO	YES	NO	NO

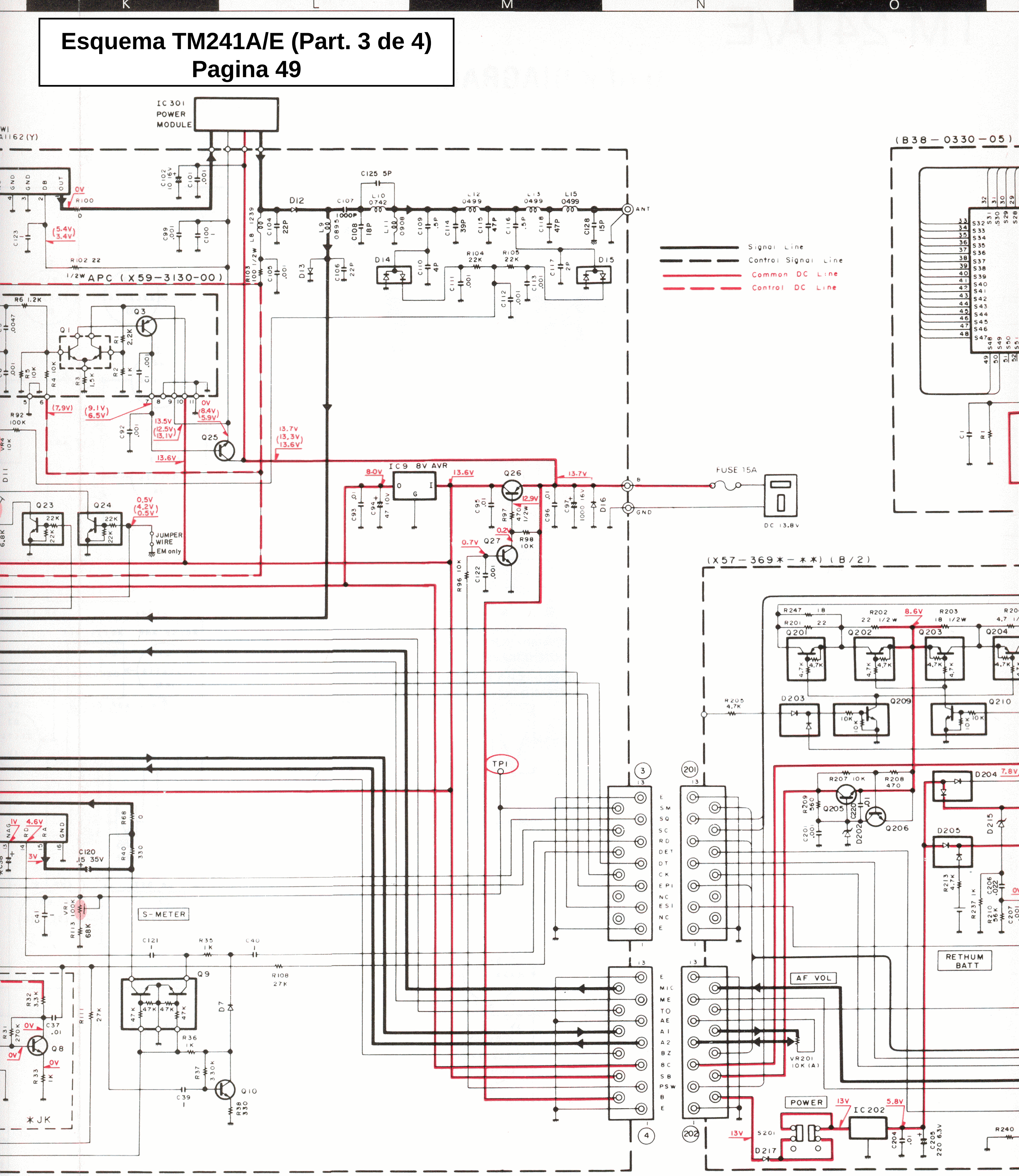
IC1 : KCD04
IC2 : TA7787AF
IC3 : UPC1241H
IC4 : KCC02
IC5 : TC9174F
IC6 : NJM78L05UA

IC7 : LA5010M
IC8 : KCB05
IC9 : MC7808CT
IC301 : S-AV17

Q1 : 3SK184 (S)
Q2 : DTA114YK
Q3 : DTC123JK
Q4 : 3SK131 (L)
Q5,22 : 2SC2714 (Y)
Q6,21 : 2SK208 (Y)

Q7
Q8,10
Q9
Q12,1
Q13,1
Q15

Esquema TM241A/E (Part. 3 de 4)
Pagina 49


K
L
M
N
O
IC301 POWER MODULE
APC (X59-3130-00)
(B38-0330-05)
(X57-369*-**) (B/2)
Signal Line
Control Signal Line
Common DC Line
Control DC Line
ANT
FUSE 15A
DC 13.8V
GND
IC9 8V AVR
Q25
Q26
Q27
Q23
Q24
JUMPER WIRE EM only
S-METER
TP1
Q9
Q10
Q8
*JK
Q201
Q202
Q203
Q204
Q205
Q206
Q209
Q210
D203
D204
D205
D215
D217
RETHUM BATT
AF VOL
VR201 10K (A)
POWER
S201
IC202
E
SM
SQ
SC
RD
DET
DT
CK
EPI
NC
ESI
NC
E
E
MIC
ME
TO
AE
A1
A2
BZ
8C
SB
PSW
B
E

: KCD04
: TA7787AF
: UPC1241H
: KCC02
: TC9174F
: NJM78L05UA

IC7 : LA5010M
IC8 : KCB05
IC9 : MC7808CT
IC301 : S-AV17

Q1 : 3SK184 (S)
Q2 : DTA114YK
Q3 : DTC123JK
Q4 : 3SK131 (L)
Q5,22 : 2SC2714 (Y)
Q6,21 : 2SK208 (Y)

Q7 : DTC143EK
Q8,10,16~18,20,27 : 2SC2712 (Y)
Q9 : FMG2
Q12,19 : 2SD1757K
Q13,14 : 2SB1119 (S)
Q15 : DTC144WK

Q23,24 : DTC124EK
Q25 : 2SD1406 (Y)
Q26 : 2SB1302 (S)
Q28 : 2SJ106 (GR)

D1,10 : DAN235K
D2~6 : 1SV164
D7 : LFB01
D8,9 : 1SS184
D11 : 1SS181
D13 : MI308

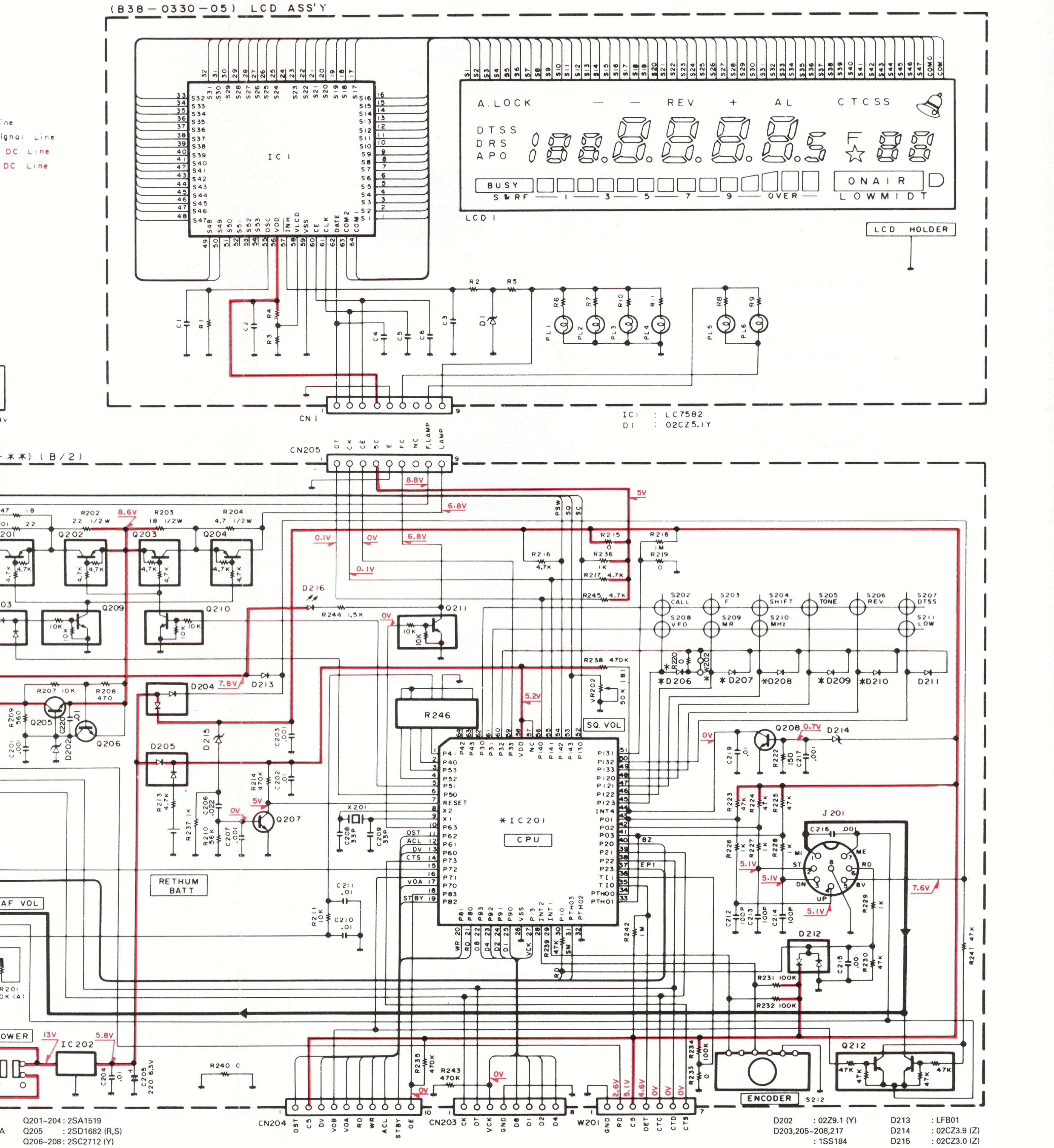
D14,15 : 1SS226
D16 : DSA3A1
D12 : MI407

IC201 : *
IC202 : NJM78L06UA

Q201~204 : 2SA1519
Q205 : 2SD1682 (R,S)
Q206~208 : 2SC2712 (Y)
Q209,210 : DTC114EK
Q211 : DTD143EK
Q212 : FMG2

Esquema TM241A/E (Part. 4 de 4)
Pagina 50

SCHEMATIC DIAGRAM


(B38-0330-05) LCD ASS'Y
IC1
LCD1
LCD HOLDER
A.LOCK
REV
AL
CTCSS
DTSS
DRS
APO
BUSY
S & RF
OVER
ON AIR
LOW MID T
R2
R5
R6
R7
R10
R11
R8
R9
PL1
PL2
PL3
PL4
PL5
PL6
C1
R1
C2
R4
R3
C4
C5
C6
C3
D1
CN1
CN205
DT
CK
CE
5C
E
FC
NC
F.LAMP
LAMP
8.8V
6.8V
5V
R202
R203
R204
8.6V
Q202
Q203
Q204
Q209
Q210
Q211
0.1V
0V
D216
R244 1.5K
R215
R216
R236
R217 4.7K
R219 1M
R245 4.7K
PSW
SQ
SC
S202 CALL
S203 F
S204 SHIFT
S205 TONE
S206 REV
S207 DTSS
S208 VFO
S209 MR
S210 MHz
S211 LOW
R238 470K
R220
W202
*D206
*D207
*D208
*D209
*D210
D211
VR202
50K (B)
SQ. VOL
R246
5.2V
D204
7.8V
D213
R207 10K
R208 470
Q205
Q206
D205
D215
C203
R214 470K
C202
5V
Q207
X201
C208 33P
C209 33P
*IC201
CPU
RETHUM BATT
AF VOL
C211
C210
R211 10K
Q208
0.7V
D214
C219
R222
C217
R223 47K
R224 47K
R225 47K
J201
C216
R226
R227
R228
MI
ME
ST
RD
DN
UP
8V
5.1V
7.6V
C212
C213
C214
D212
R229 1K
C215
R230 47K
R231 100K
R232 100K
R241 47K
R242 1M
BZ
EP1
IC202
13V
5.8V
POWER
C204
C205 220 6.3V
R201
R240 0
R235 470K
R243 470K
R233
R234 100K
ENCODER
S212
Q212
47K
2.6V
4.6V
CN204
DST
C5
DV
VOB
VOA
RD
WR
ACL
STBY
OE
CN203
CK
DT
VCK
GND
D8
DI
D2
D4
W201
DET
CTC
CTD
CTS

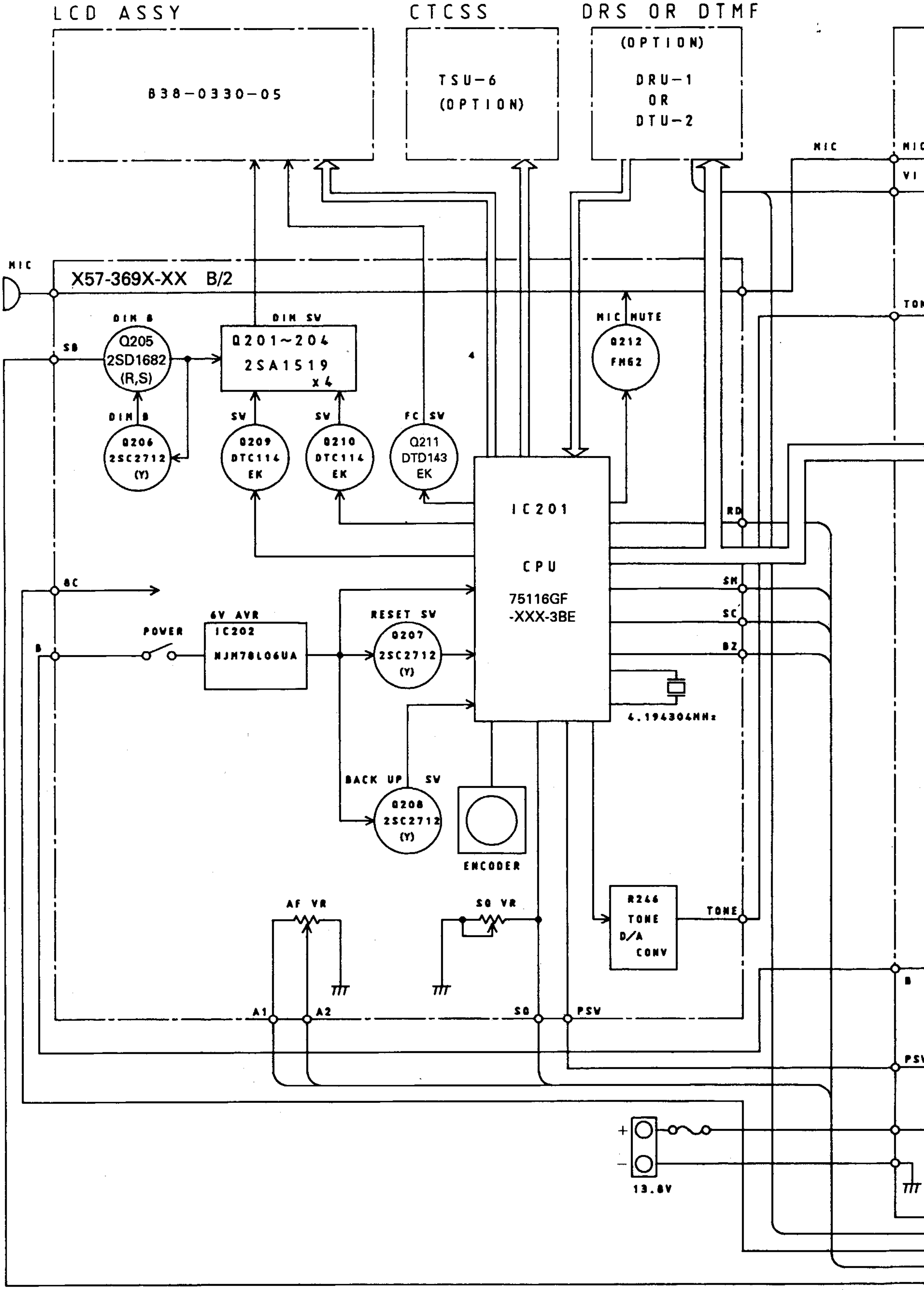
IC1 : LC7582
D1 : 02CZ5.1Y

Q201~204 : 2SA1519
Q205 : 2SD1682 (R,S)
Q206~208 : 2SC2712 (Y)
Q209,210 : DTC114EK
Q211 : DTD143EK
Q212 : FMG2

D202 : 02Z9.1 (Y)
D203,205~208,217 : 1SS184
D204 : 1SS181
D209~211 : MA141A
D212 : 1SS226

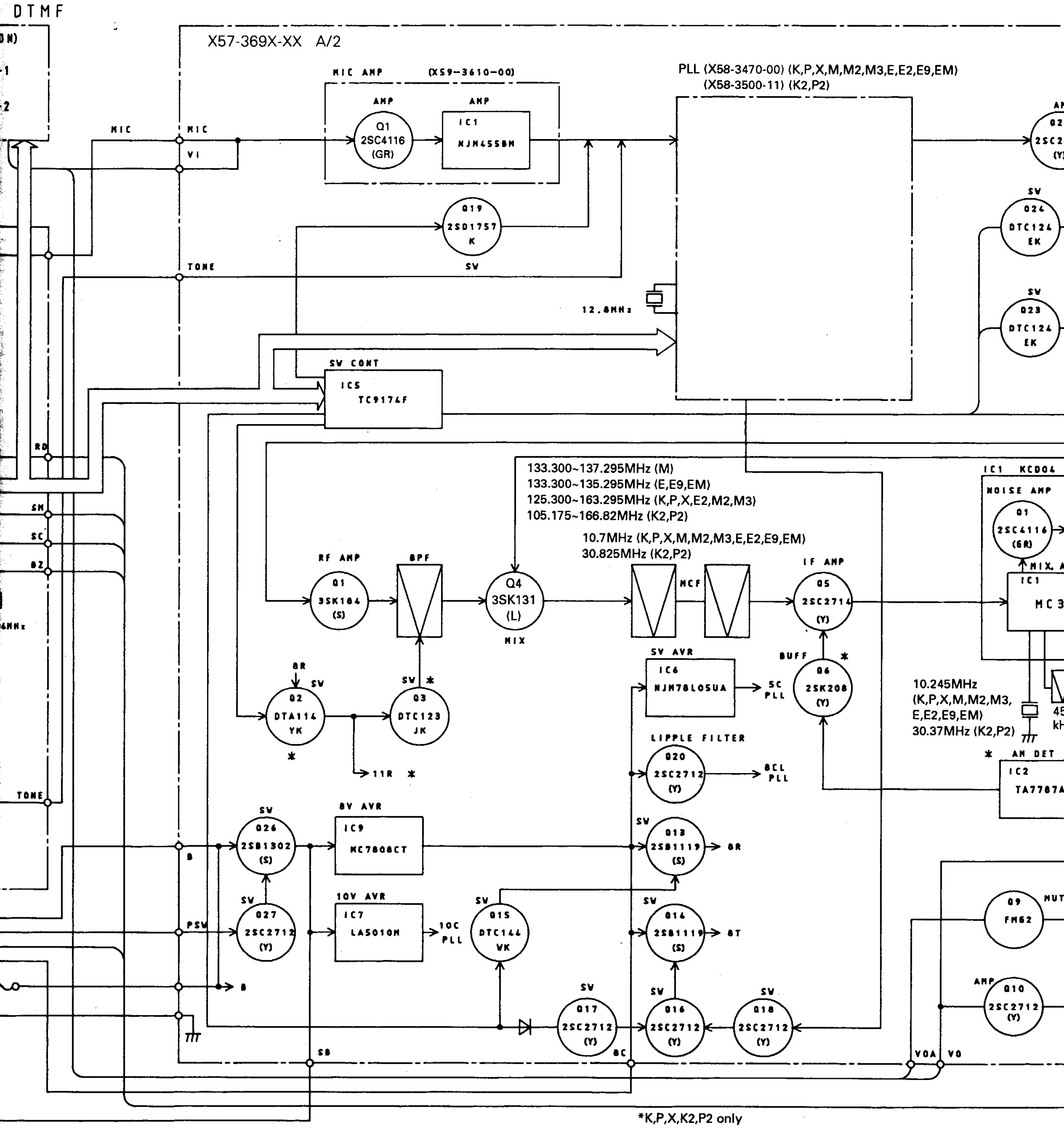
D213 : LFB01
D214 : 02CZ3.9 (Z)
D215 : 02CZ3.0 (Z)
D216 : B30-0852-05

BLOCK DIAGRAM
1 de 3


LCD ASSY
B38-0330-05
CTCSS
TSU-6
(OPTION)
DRS OR DTMF
(OPTION)
DRU-1
OR
DTU-2
MIC
X57-369X-XX B/2
DIM 8
Q205
2SD1682
(R,S)
DIM SW
Q201~204
2SA1519
x 4
DIM 8
Q206
2SC2712
(Y)
SW
Q209
DTC114
EK
SW
Q210
DTC114
EK
FC SW
Q211
DTD143
EK
MIC MUTE
Q212
FN62
4
SB
IC201
CPU
75116GF
-XXX-3BE
RD
SH
SC
BZ
4.194304MHz
8C
POWER
B
6V AVR
IC202
NJM78L06UA
RESET SW
Q207
2SC2712
(Y)
BACK UP SW
Q208
2SC2712
(Y)
ENCODER
AF VR
SQ VR
R246
TONE
D/A
CONV
TONE
A1
A2
SQ
PSW
+
−
13.8V
MIC
VI
B

BLOCK DIAGRAM
2 de 3

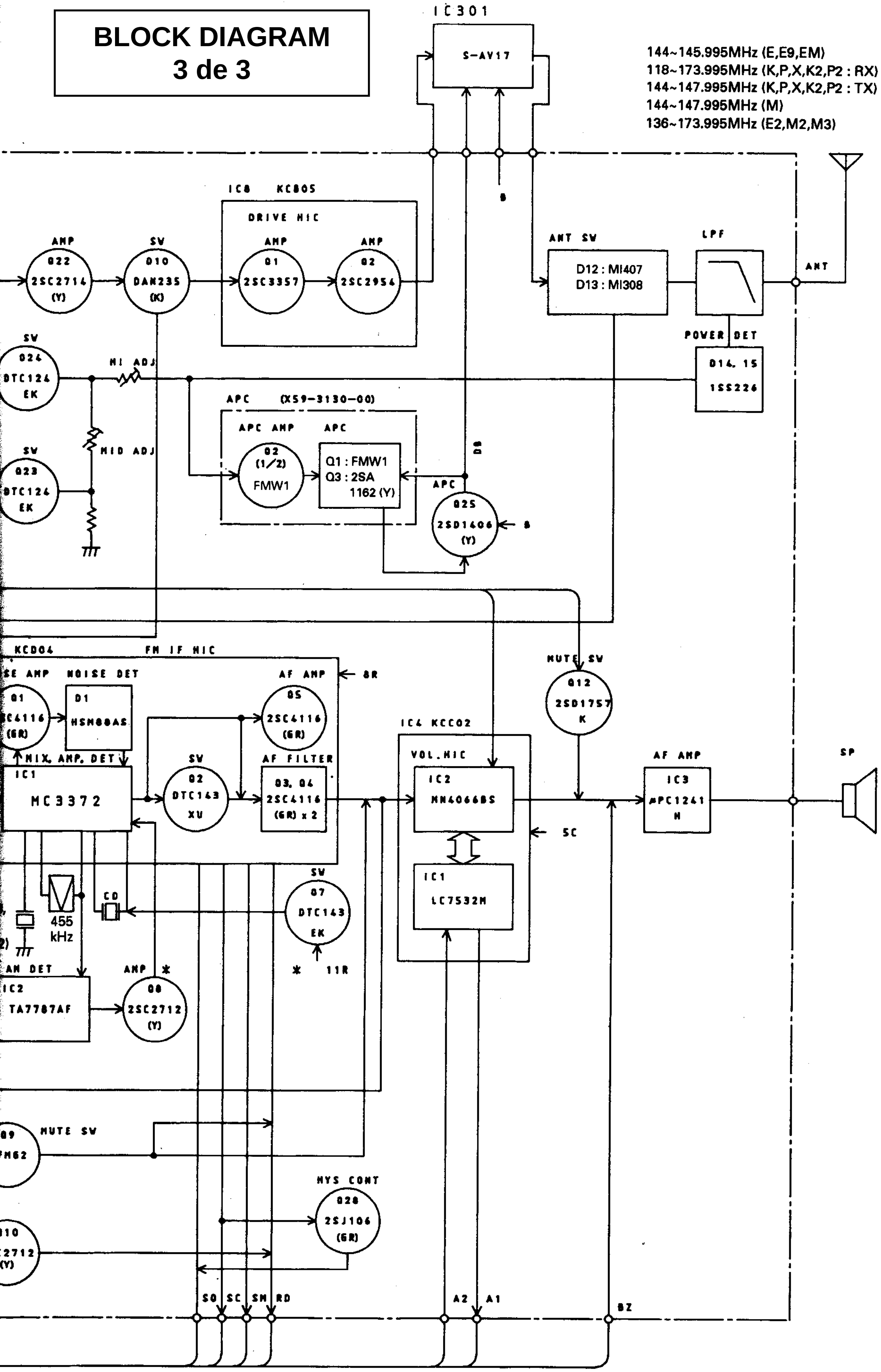
BLOCK DIAGRAM


DTMF
X57-369X-XX A/2
MIC AMP (X59-3610-00)
AMP
Q1
2SC4116
(GR)
AMP
IC1
NJM4558M
PLL (X58-3470-00) (K,P,X,M,M2,M3,E,E2,E9,EM)
(X58-3500-11) (K2,P2)
MIC
MIC
VI
Q19
2SD1757
K
SW
TONE
12.8MHz
SW CONT
IC5
TC9174F
RD
SW
SC
BZ
TONE
AMP
Q2
2SC2
SW
Q24
DTC124
EK
SW
Q23
DTC124
EK
133.300~137.295MHz (M)
133.300~135.295MHz (E,E9,EM)
125.300~163.295MHz (K,P,X,E2,M2,M3)
105.175~166.82MHz (K2,P2)
10.7MHz (K,P,X,M,M2,M3,E,E2,E9,EM)
30.825MHz (K2,P2)
RF AMP
Q1
3SK184
(S)
BPF
Q4
3SK131
(L)
MIX
MCF
IF AMP
Q5
2SC2714
(Y)
BUFF
Q6
2SK208
(Y)
IC1 KCD04
NOISE AMP
Q1
2SC4116
(GR)
MIX
IC1
MC3
10.245MHz
(K,P,X,M,M2,M3,
E,E2,E9,EM)
30.37MHz (K2,P2)
45
kH
AM DET
IC2
TA7787A
8R
SW
Q2
DTA114
YK
SW
Q3
DTC123
JK
11R
SW AVR
IC6
NJM78L05UA
5C
PLL
LIPPLE FILTER
Q20
2SC2712
(Y)
8CL
PLL
SW
Q26
2SB1302
(S)
8V AVR
IC9
MC7808CT
SW
Q13
2SB1119
(S)
8R
B
SW
Q27
2SC2712
(Y)
PSW
10V AVR
IC7
LA5010M
10C
PLL
SW
Q15
DTC144
VK
SW
Q14
2SB1119
(S)
8T
B
SW
Q17
2SC2712
(Y)
SW
Q16
2SC2712
(Y)
SW
Q18
2SC2712
(Y)
SB
8C
Q9
FM62
MUT
AMP
Q10
2SC2712
(Y)
VOA
VO
*

*K,P,X,K2,P2 only

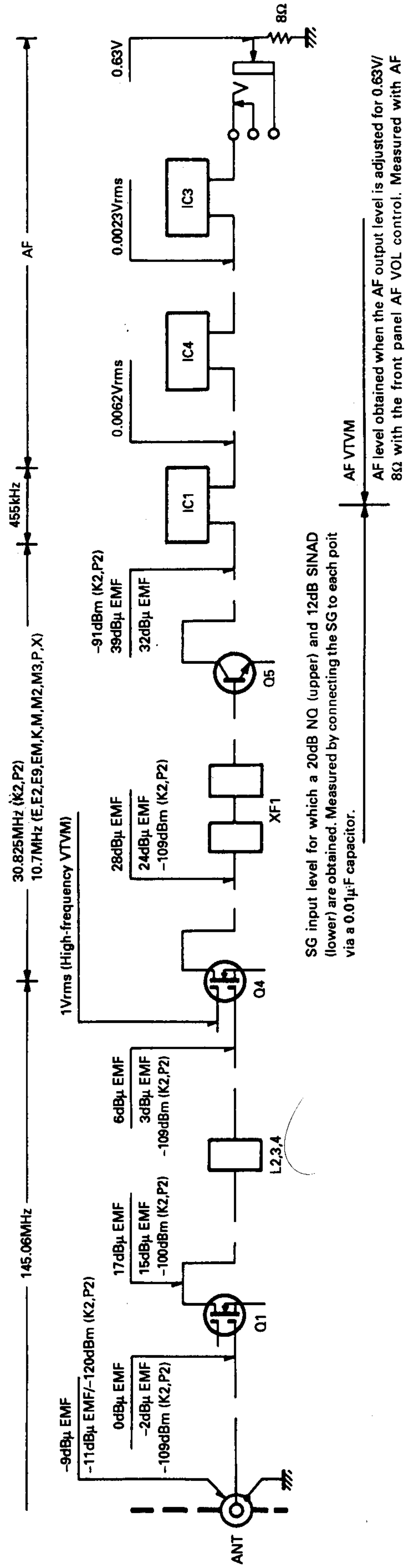
BLOCK DIAGRAM
3 de 3

144~145.995MHz (E,E9,EM)
118~173.995MHz (K,P,X,K2,P2 : RX)
144~147.995MHz (K,P,X,K2,P2 : TX)
144~147.995MHz (M)
136~173.995MHz (E2,M2,M3)


IC301
S-AV17
B
IC8 KC805
DRIVE HIC
AMP
Q22
2SC2714
(Y)
SW
D10
DAN235
(K)
AMP
Q1
2SC3357
AMP
Q2
2SC2954
ANT SW
D12 : MI407
D13 : MI308
LPF
ANT
POWER DET
D14, 15
1SS226
SW
Q24
DTC124
EK
HI ADJ
MID ADJ
SW
Q23
DTC124
EK
APC (X59-3130-00)
APC AMP
Q2
(1/2)
FMW1
APC
Q1 : FMW1
Q3 : 2SA
1162 (Y)
DB
APC
Q25
2SD1406
(Y)
B
KCD04
FM IF HIC
SE AMP
Q1
C4116
(GR)
NOISE DET
D1
HSM88AS
AF AMP
Q5
2SC4116
(GR)
8R
MIX, AMP, DET
IC1
MC3372
SW
Q2
DTC143
XU
AF FILTER
Q3, Q4
2SC4116
(GR) x 2
455
kHz
CD
SW
Q7
DTC143
EK
11R
*
AM DET
IC2
TA7787AF
AMP *
Q8
2SC2712
(Y)
MUTE SW
Q12
2SD1757
K
IC4 KCC02
VOL.HIC
IC2
MN4066BS
IC1
LC7532M
SC
AF AMP
IC3
μPC1241
H
SP
Q9
FN62
MUTE SW
Q10
C2712
(Y)
HYS CONT
Q28
2SJ106
(GR)
SO
SC
SM
RD
A2
A1
BZ

LEVEL DIAGRAM

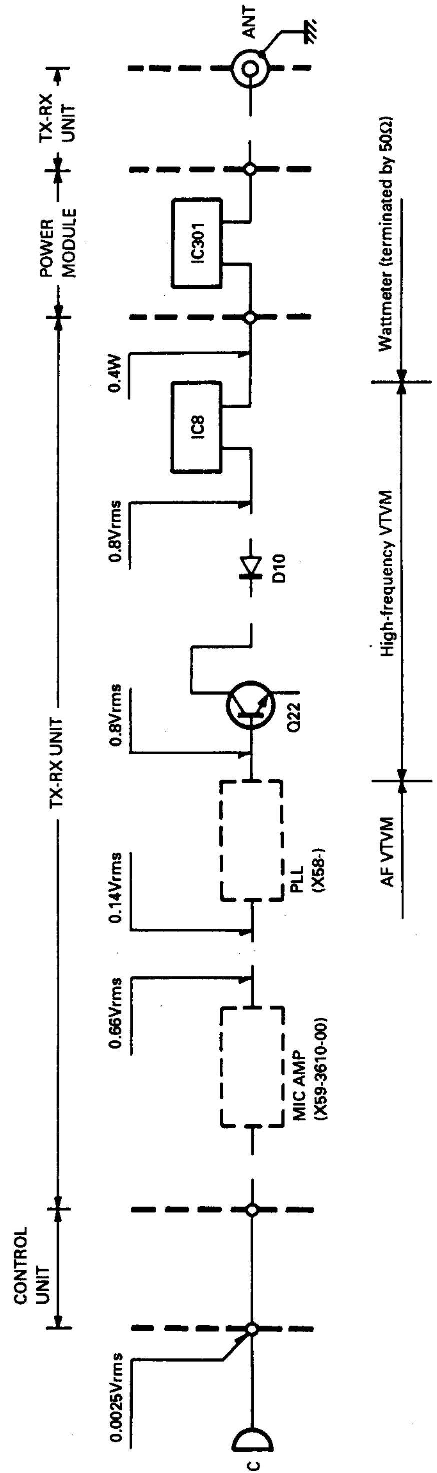
Receiver section


145.06MHz
30.825MHz (K2,P2)
10.7MHz (E,E2,E9,EM,K,M,M2,M3,P,X)
455kHz
AF
-9dBμ EMF
-11dBμ EMF/-120dBm (K2,P2)
0dBμ EMF
-2dBμ EMF
-109dBm (K2,P2)
17dBμ EMF
15dBμ EMF
-100dBm (K2,P2)
6dBμ EMF
3dBμ EMF
-109dBm (K2,P2)
1Vrms (High-frequency VTVM)
28dBμ EMF
24dBμ EMF
-109dBm (K2,P2)
-91dBm (K2,P2)
39dBμ EMF
32dBμ EMF
0.0062Vrms
0.0023Vrms
0.63V
8Ω
ANT
Q1
L2,3,4
Q4
XF1
Q5
IC1
IC4
IC3
AF VTVM

SG input level for which a 20dB NQ (upper) and 12dB SINAD (lower) are obtained. Measured by connecting the SG to each poit via a 0.01μF capacitor.

AF level obtained when the AF output level is adjusted for 0.63V/8Ω with the front panel AF VOL control. Measured with AF voltmeter connected to the external speaker jack, receiving a 40dB EMF SSG signal modulated at 1kHz, DEV 3kHz.

Transmitter section


CONTROL UNIT
TX-RX UNIT
POWER MODULE
TX-RX UNIT
0.0025Vrms
0.66Vrms
0.14Vrms
0.8Vrms
0.8Vrms
0.4W
MIC
MIC AMP (X59-3610-00)
PLL (X58-)
Q22
D10
IC8
IC301
ANT
AF VTVM
High-frequency VTVM
Wattmeter (terminated by 50Ω)

1. AG is set so that MIC input becomes 3kHz DEV at 1kHz MOD.
2. Transmitting frequency : 145.06MHz.

DRU-1 (DIGITAL RECORDING UNIT)

DRU-1 CIRCUIT DESCRIPTION

1. Overview

The DRU-1 is a digital recording and playback unit designed to be installed inside the TM-241 A/E series. This unit has the following features:

- Recording received audio (for output to the internal speaker) or transmit audio (microphone input)
- Outputting recorded audio to the internal speaker or outputting recorded audio as modulating signals during transmission
- Built-in lithium battery back-up for maintaining DRU-1 contents
- DTSS and paging code reception.

2. Operations

• Recording received audio (for output to the internal speaker)

A received signal from the VO pin is fed into pin 1 (0Y) of the multiplexer IC1 (TC4052BF). It is then fed into pin 59 (MIC IN) of IC3 (TC8830AF) via pin 3 (Y). The signal is amplified approx. 26dB by a mic amplifier in IC3, and output via pin 60 (C1). The signal from pin 60 is fed into pin 63 (C2) and amplified approx. 20dB. The amplified signal is applied to pin 64 (MIC OUT) and pin 65 (ADI).

• Recording transmit audio (microphone input)

Microphone input from the VI pin is amplified by Q5, and fed into pin 2 (2Y) of the multiplexer IC1 (TC4052BF). It is then supplied to IC3 (TC8830AF) via pin 3 (Y) and recorded in the same way as in recording received sound.

• Outputting recorded audio to the internal speaker

D/A convertor output from pin 66 (DAO) of IC3 (TC8830AF) is passed through a CR filter, and amplified by Q6. The amplified signal is then fed into pin 13 (X) of the multiplexer IC1 (TC4052BF), and output to the VO pin via pin 14 (1X).

• Outputting recorded audio as modulating signals during transmission

When sound recorded in the DRU-1 is played during transmission, the same operations as written above in outputting recorded audio to the internal speaker occur. That is, D/A convertor output from pin 66 (DAO) of IC3 (TC8830AF) is passed through a CR filter, amplified by Q6, and fed into pin 13 (X) of the multiplexer IC1 (TC4052BF). The sound, however, is output via pin 11 (3X).

	VOA (pin 10)	VOB (pin 9)	On channel
Output to speaker	H	L	1X (pin 14)
Output during transmission	H	H	3X (pin 11)
Received audio recording	L	L	0Y (pin 1)
Transmit aidop recording	L	H	2Y (pin 2)

Table 1 IC1 : TC4052BF operations

● DTSS and paging code reception

The DTMF signal input from the VO pin is amplified by Q1 and input to pin 12 of DTMF decoder IC2 (LR4102N). When the DTMF signal is input to IC2, pin 20 (DV pin) is made high. A DTMF code is then output to pins 1 (D1), 24 (D2), 23 (D4), and 22 (D8) of IC2. The CPU can receive the DTMF signal by detecting the DTMF signal input from the DV pin and reading D1, D2, D4, and D8 data.

DRU-1 DESCRIPTION OF COMPONENTS

ACCESSORY UNIT (X42-3010-00)

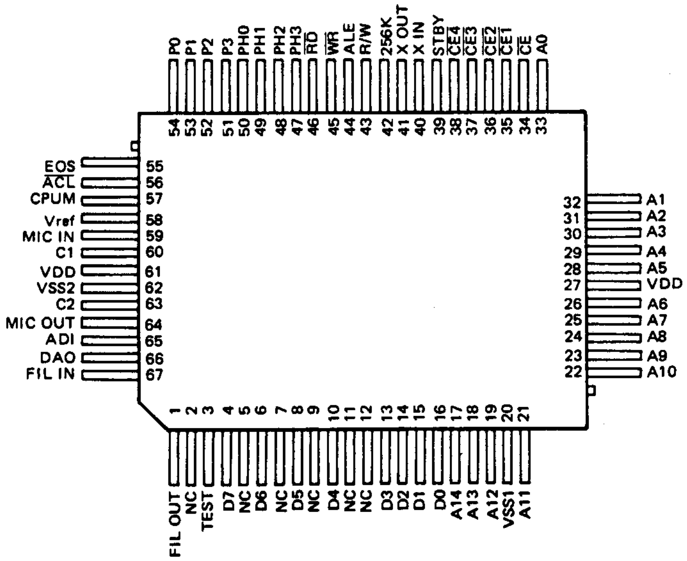
Component	Use/Function	Description
IC1	Multiplexer	See DRU-1 circuit description.
IC2	DTMF decode	
IC3	Audio recording and playback	See DRU-1 semiconductor data.
IC4~7	S-RAM	
Q1	AF amplification	Recieve DTMF input amplification.
Q2	AF amplification	DTMF (from MIC) input amplification.
Q3	AF amplification	BEEP.
Q4	Switch	BEEP AMP.
Q5	AF amplification	Mic input amplification.
Q6	AF amplification	Playback sound amplification.
Q7	Switch	ACL line.
D1	Reverse current prevention	
D2	Reverse current prevention	Back-up.

DRU-1 (DIGITAL RECORDING UNIT)

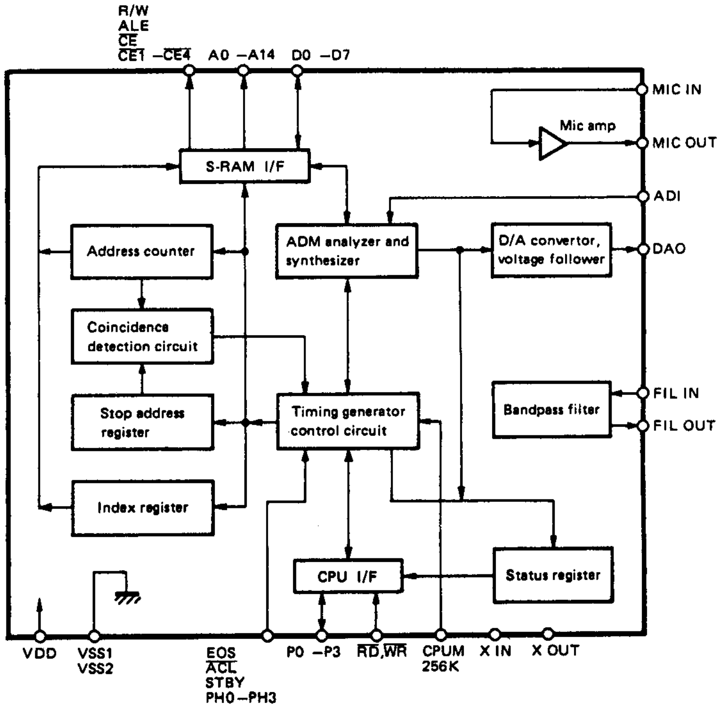
DRU-1 SEMICONDUCTOR DATA

1. Audio recording and playback : TC8830AF (IC3)

• Terminal connection diagram


P0
P1
P2
P3
PH0
PH1
PH2
PH3
RD
WR
ALE
R/W
256K
X OUT
X IN
STBY
CE4
CE3
CE2
CE1
CE
A0
EOS
ACL
CPUM
Vref
MIC IN
C1
VDD
VSS2
C2
MIC OUT
ADI
DAO
FIL IN
A1
A2
A3
A4
A5
VDD
A6
A7
A8
A9
A10
FIL OUT
NC
TEST
D7
NC
D6
NC
D5
NC
D4
NC
NC
D3
D2
D1
D0
A14
A13
A12
VSS1
A11

• Block diagram


R/W
ALE
CE
CE1 –CE4
A0 –A14
D0 –D7
MIC IN
Mic amp
MIC OUT
S-RAM I/F
ADI
Address counter
ADM analyzer and synthesizer
D/A convertor, voltage follower
DAO
Coincidence detection circuit
Stop address register
Timing generator control circuit
Bandpass filter
FIL IN
FIL OUT
Index register
CPU I/F
Status register
VDD
VSS1
VSS2
EOS
ACL
STBY
PH0 –PH3
P0 –P3
RD,WR
CPUM
256K
X IN
X OUT

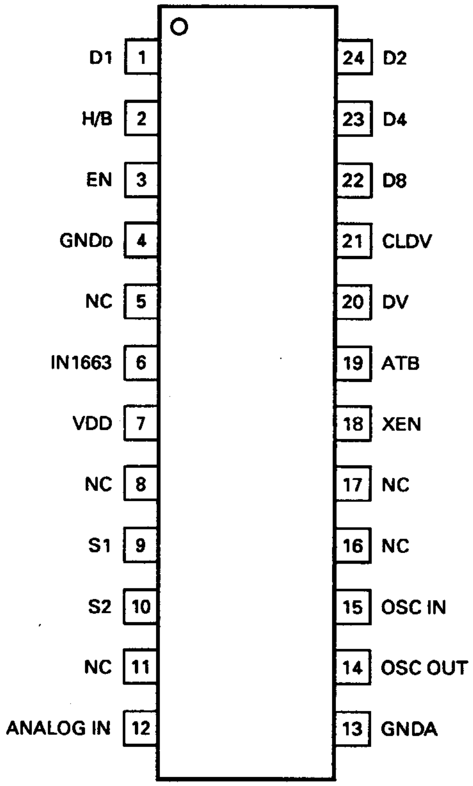
• Terminal functions

Pin No.	Pin name	I/O	Function	Pin No.	Pin name	I/O	Function
1	FIL OUT	O	Not used.	41	X OUT	O	512kHz oscillation circuit.
2	NC	–	Not connected.	42	256K	I	64K/256K RAM select, "H" when 256K used.
3	TEST	–	Not used.				
4	D7	I/O	RAM data I/O.	43	R/W	O	RAM read/write output.
5	NC	–	Not connected.	44	ALE	–	Not used.
6	D6	I/O	RAM data I/O.	45	WR	I	Write pulse input.
7	NC	–	Not connected.	46	RD	I	Read pulse input.
8	D5	I/O	RAM data I/O.	47~50	PH3~PH0	–	Not used.
9	NC	–	Not connected.	51~54	P3~P0	I/O	Data bus.
10	D4	I/O	RAM data I/O.	55	EOS	–	Not used.
11,12	NC	–	Not connected.	56	ACL	I	Reset signal input.
13~16	D3~D0	I/O	RAM data I/O.	57	CPUM	I	"H" when CPU control enabled.
17~19	A14~A12	O	RAM address output.	58	Vref	O	Analog circuit reference voltage output.
20	Vss1	–	GND.	59	MIC IN	I	Mic amp. 1 input.
21~26	A11~A6	O	RAM address output.	60	C1	O	Mic amp. 1 output.
27	VDD	–	Power supply.	61	VDD	–	Power supply.
28~33	A5~A0	O	RAM address output.	62	Vss2	–	GND.
34	CE	–	Not used.	63	C2	I	Mic amp. 2 input.
35~38	CE1~CE4	O	RAM chip enable.	64	MIC OUT	O	Mic amp. 2 output.
39	STBY	I	Minimum current standby when standby input is "H".	65	ADI	I	Audio analysis circuit input.
				66	DAO	O	D/A convertor output.
40	X IN	I	512kHz oscillation circuit.	67	FIL IN	I	Not used.

DRU-1 (DIGITAL RECORDING UNIT)

2. DTMF decoder : LR4102N (IC2)

• Terminal connection diagram


D1 1
H/B 2
EN 3
GNDD 4
NC 5
IN1663 6
VDD 7
NC 8
S1 9
S2 10
NC 11
ANALOG IN 12
24 D2
23 D4
22 D8
21 CLDV
20 DV
19 ATB
18 XEN
17 NC
16 NC
15 OSC IN
14 OSC OUT
13 GNDA

(Top view)

• Terminal functions

Pin No.	Name	I/O	Function
1	D1	O	DTMF data output.
2	H/B	I	16 digit cord setting.
3	EN	I	Output enable.
4	GNDD	–	Digital GND (GND).
5	NC	–	NC
6	IN1633	I	Valid 1633Hz (GND).
7	VDD	–	Power supply.
8	NC	–	NC
9	S1	–	Bypass (Connected to ground by a 0.01μF capacitor).
10	S2	–	Bypass (Connected to ground by a 0.01μF capacitor).
11	NC	–	NC
12	ANALOG IN	I	DTMF signal input.
13	GNDA	–	Analog GND.
14	OSC OUT	O	X-tal output.
15	OSC IN	I	X-tal input.
16	NC	–	NC
17	NC	–	NC
18	XEN	I	X-tal enable.
19	ATB	O	NC
20	DV	O	Data varied.
21	CLDV	I	Data varied clear.
22	D8	O	DTMF data output.
23	D4	O	DTMF data output.
24	D2	O	DTMF data output.

DRU-1 (DIGITAL RECORDING UNIT)

DRU-1 PARTS LIST

⁎ New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnes dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
DRU-1						
			B42-3317-04	LABEL		
-			B50-8290-00	INSTRUCTION MANUAL		
			G10-0666-04	NON-WOVEN FABRIC		
			G10-0679-04	NON-WOVEN FABRIC		
			G13-0913-04	FORMED PLATE		
-			H01-8249-03	ITEM CARTON BOX		
-			H03-2772-04	OUTER PACKING CASE		
-			H21-0704-04	PROTECTION SHEET		
-			H25-0029-04	PROTECTION BAG		
-			H25-0710-04	PROTECTION BAG		
			N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
			X42-3010-00	ACCESSORY UNIT		
ACCESSORY UNIT (X42-3010-00)						
C1			CK73FB1H103K	CHIP C 0.010UF K		
C2			CK73FB1H102K	CHIP C 1000PF K		
C3			CK73FF1E154Z	CHIP C 0.15UF Z		
C4 -6			CK73FB1H103K	CHIP C 0.010UF K		
C7			CK73EF1C105Z	CHIP C 1.0UF Z		
C8 -10			CK73FB1H103K	CHIP C 0.010UF K		
C11			CK73FF1E104Z	CHIP C 0.10UF Z		
C12			CK73FB1H103K	CHIP C 0.010UF K		
C14			CK73FB1H102K	CHIP C 1000PF K		
C15			CK73FF1E104Z	CHIP C 0.10UF Z		
C13			CK73FB1H222K	CHIP C 2200PF K		
C16			CK73FB1H103K	CHIP C 0.010UF K		
C17			CK73FF1E104Z	CHIP C 0.10UF Z		
C19			CK73FB1H103K	CHIP C 0.010UF K		
C20			CK73FB1H102K	CHIP C 1000PF K		
C21 ,22			CC73FSL1H101J	CHIP C 100PF J		
C23			CK73FB1H103K	CHIP C 0.010UF K		
C24			C92-0010-05	CHIP TAN 6.8UF 6.3WV		
C25			CK73FF1E104Z	CHIP C 0.10UF Z		
C26			CK73FB1H333K	CHIP C 0.033UF K		
C27			CC73FSL1H101J	CHIP C 100PF J		
C28			CK73EB1H104K	CHIP C 0.10UF K		
C29			C92-0005-05	CHIP TAN 2.2UF 6.3WV		
CN1			E40-5207-05	PIN CONNECTOR		
CN2			E40-5206-05	PIN CONNECTOR		
CN3			E40-5181-05	PIN CONNECTOR		
W1			E31-6005-05	CONNECTING WIRE		
W2			E31-6006-05	CONNECTING WIRE		
W3			E31-6007-05	CONNECTING WIRE		
			F20-0520-04	INSULATING BOARD		
			F20-0521-04	INSULATING BOARD		
X1			L77-1398-05	CRYSTAL RESONATOR 3.579545MHZ		
X2			L78-0050-05	RESONATOR 512KHZ		
R1			RK73FB2A103J	CHIP R 10K J 1/10W		
R2			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R3			RK73FB2A103J	CHIP R 10K J 1/10W		
R4			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R5			RK73FB2A102J	CHIP R 1.0K J 1/10W		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

⁎ New Parts

DRU-1 (DIGITAL RECORDING UNIT)

Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Teile ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
R6			R92-0670-05	CHIP R 0 OHM		
R7			RK73FB2A223J	CHIP R 22K J 1/10W		
R8			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R9			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R10			R92-0670-05	CHIP R 0 OHM		
R11			RK73FB2A223J	CHIP R 22K J 1/10W		
R12,13			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R14			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R15			RK73FB2A104J	CHIP R 100K J 1/10W		
R16			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R17			RK73FB2A103J	CHIP R 10K J 1/10W		
R18			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R19			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R20			RK73FB2A104J	CHIP R 100K J 1/10W		
R21			RK73FB2A561J	CHIP R 560 J 1/10W		
R22			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R23			RK73FB2A564J	CHIP R 560K J 1/10W		
R24			RK73FB2A823J	CHIP R 82K J 1/10W		
R25			RK73FB2A223J	CHIP R 22K J 1/10W		
R26			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R27			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R28			RK73FB2A224J	CHIP R 220K J 1/10W		
R29 -31			R92-0670-05	CHIP R 0 OHM		
R32			RK73FB2A220J	CHIP R 22 J 1/10W		
R33			RK73FB2A394J	CHIP R 390K J 1/10W		
D1 ,2			1SS184	DIODE		
IC1			TC4052BF	IC(4CH MPX/DE-MPX)		
IC2			LR4102N	IC		
IC3			TC8830AF	IC		
IC4 -7			HM62256LFPI-12T	IC or HM62256LFP-12T		
Q1 -3			2SC2712(BL)	TRANSISTOR		
Q4			DTC144EK	DIGITAL TRANSISTOR		
Q5 ,6			2SC2712(BL)	TRANSISTOR		
Q7			DTC144WK	DIGITAL TRANSISTOR		
			W09-0326-05	LITHIUM BATTERY		

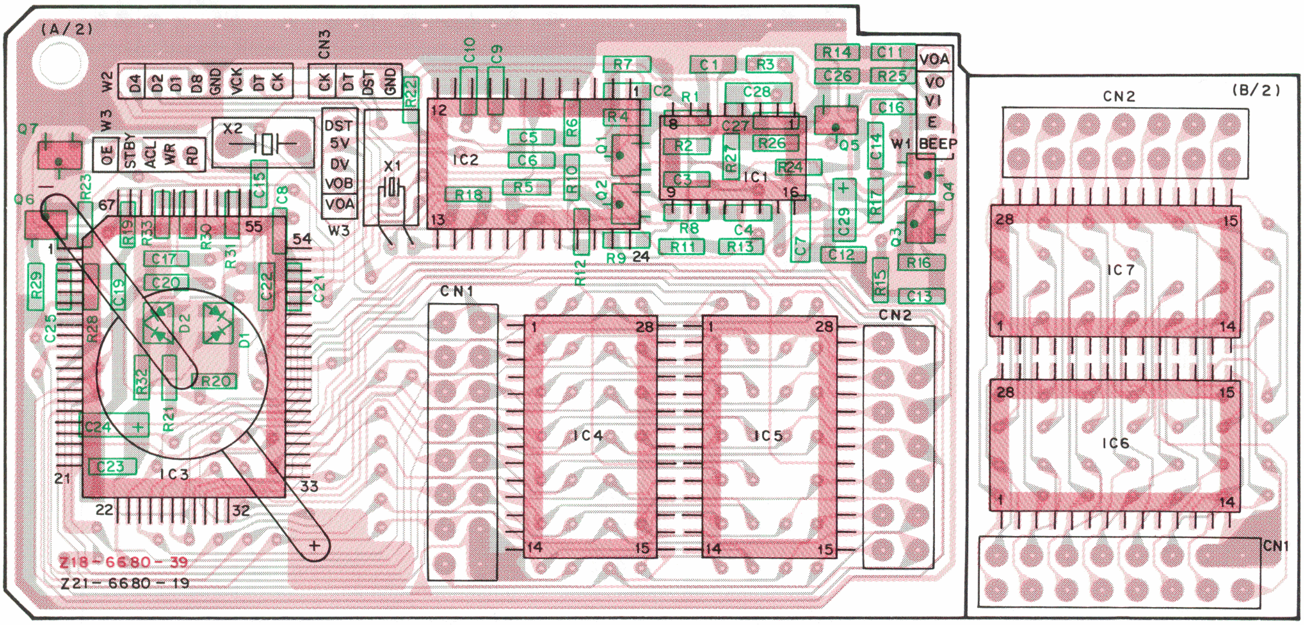
E: Scandinavia & Europe K: USA P: Canada W:Europe
U: PX(Far East, Hawaii) T: England M: Other Areas
UE : AAFES(Europe) X: Australia

⚠ indicates safety critical components.

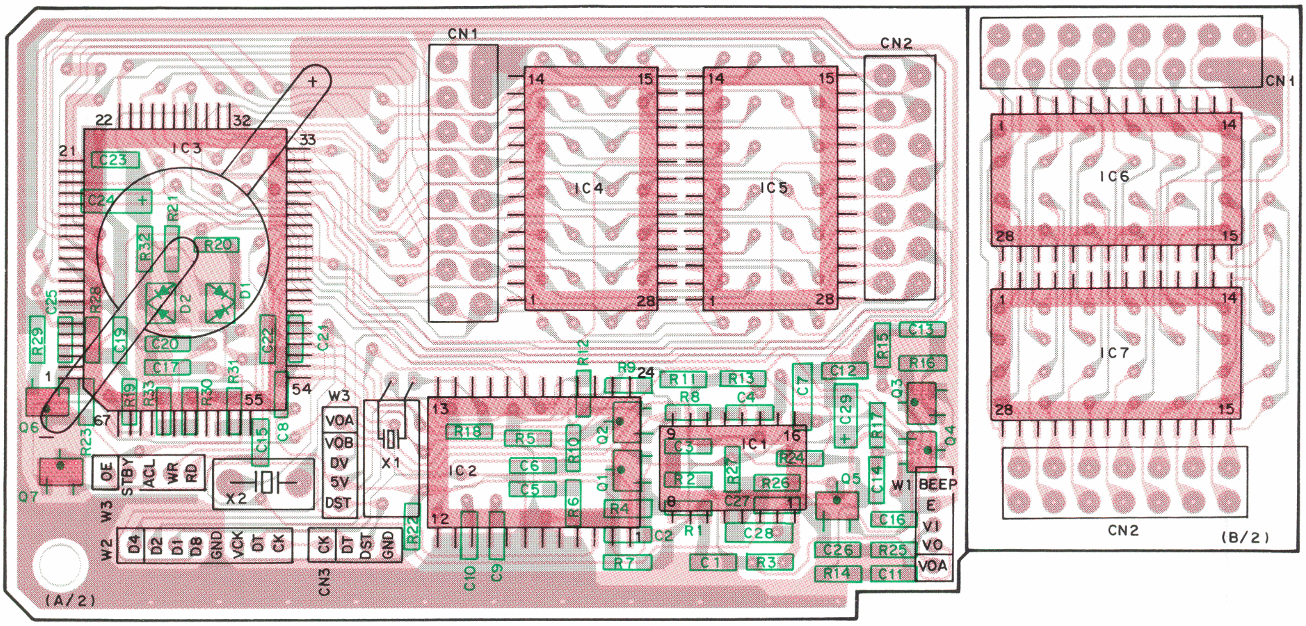
TM-241A/E DRU-1 (DIGITAL RECORDING UNIT)

DRU-1 PC BOARD VIEWS

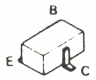
ACCESSORY UNIT (X42-3010-00) Component side view


(A/2)
(B/2)
CN1
CN2
CN3
IC1
IC2
IC3
IC4
IC5
IC6
IC7
X1
X2
W1
W2
W3
Q1
Q2
Q3
Q4
Q5
Q6
Q7
D1
D2
VOA
VO
VI
E
BEEP
DST
5V
DV
VOB
D4 D2 D1 D8 GND VCK DT CK
CK DT DST GND
OE STBY ACL WR RD
Z18-6680-39
Z21-6680-19

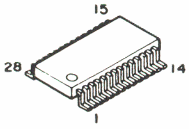
ACCESSORY UNIT (X42-3010-00) Foil side view


(A/2)
(B/2)
CN1
CN2
CN3
IC1
IC2
IC3
IC4
IC5
IC6
IC7
X1
X2
W1
W2
W3
VOA
VO
VI
E
BEEP
DST
5V
DV
VOB

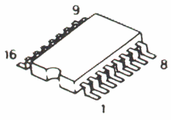
2SC2712
DTC144EK
DTC144WK



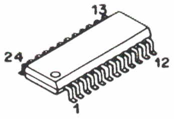
HM62256LFPI-12T



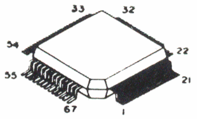
TC4052BF



LR4102N

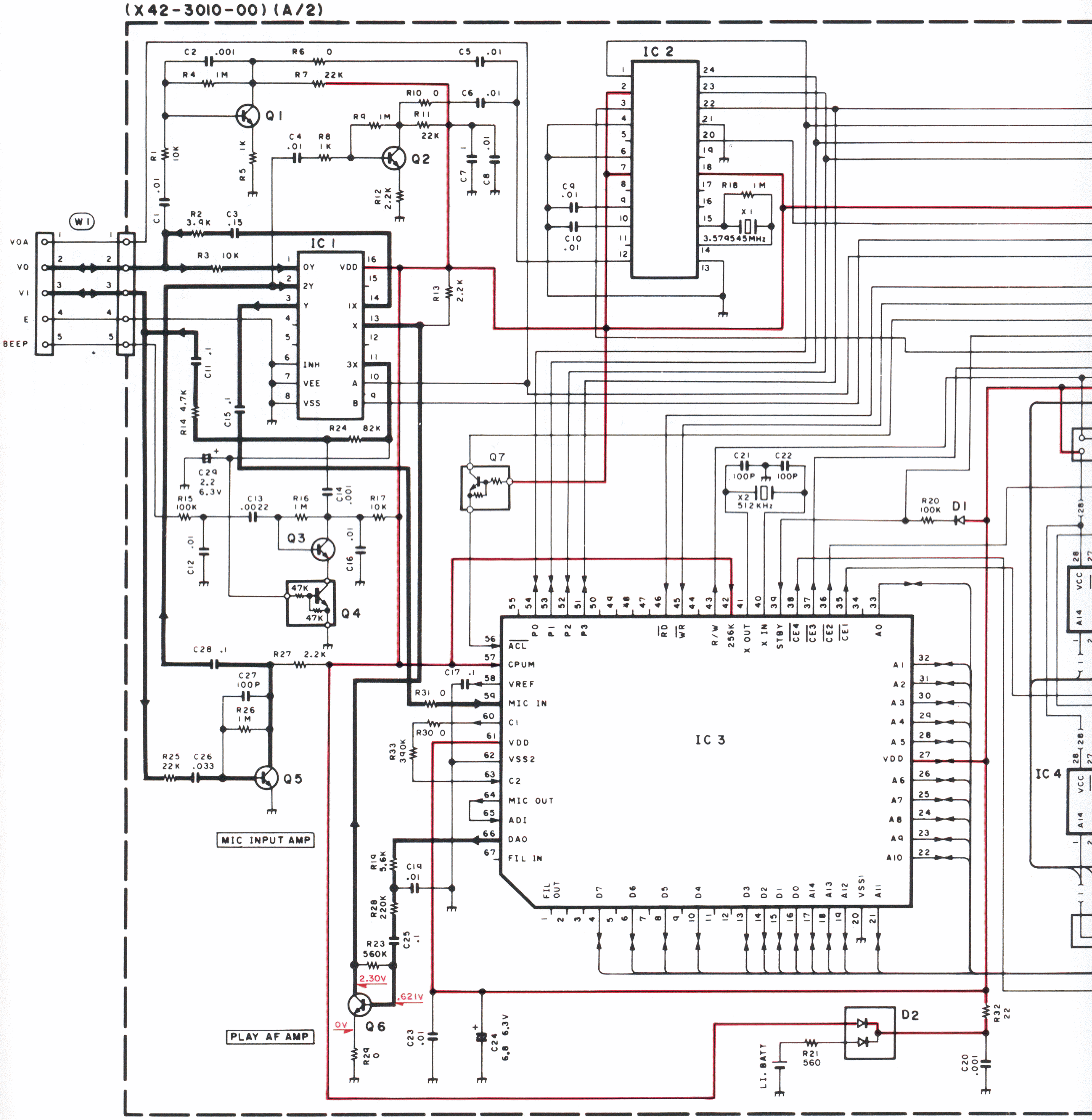


TC8830AF


33
32
54
22
55
21
67
1

Pagina 61
Esquema 1 de 2

DRU-1 SCHEMATIC DIAGRAM

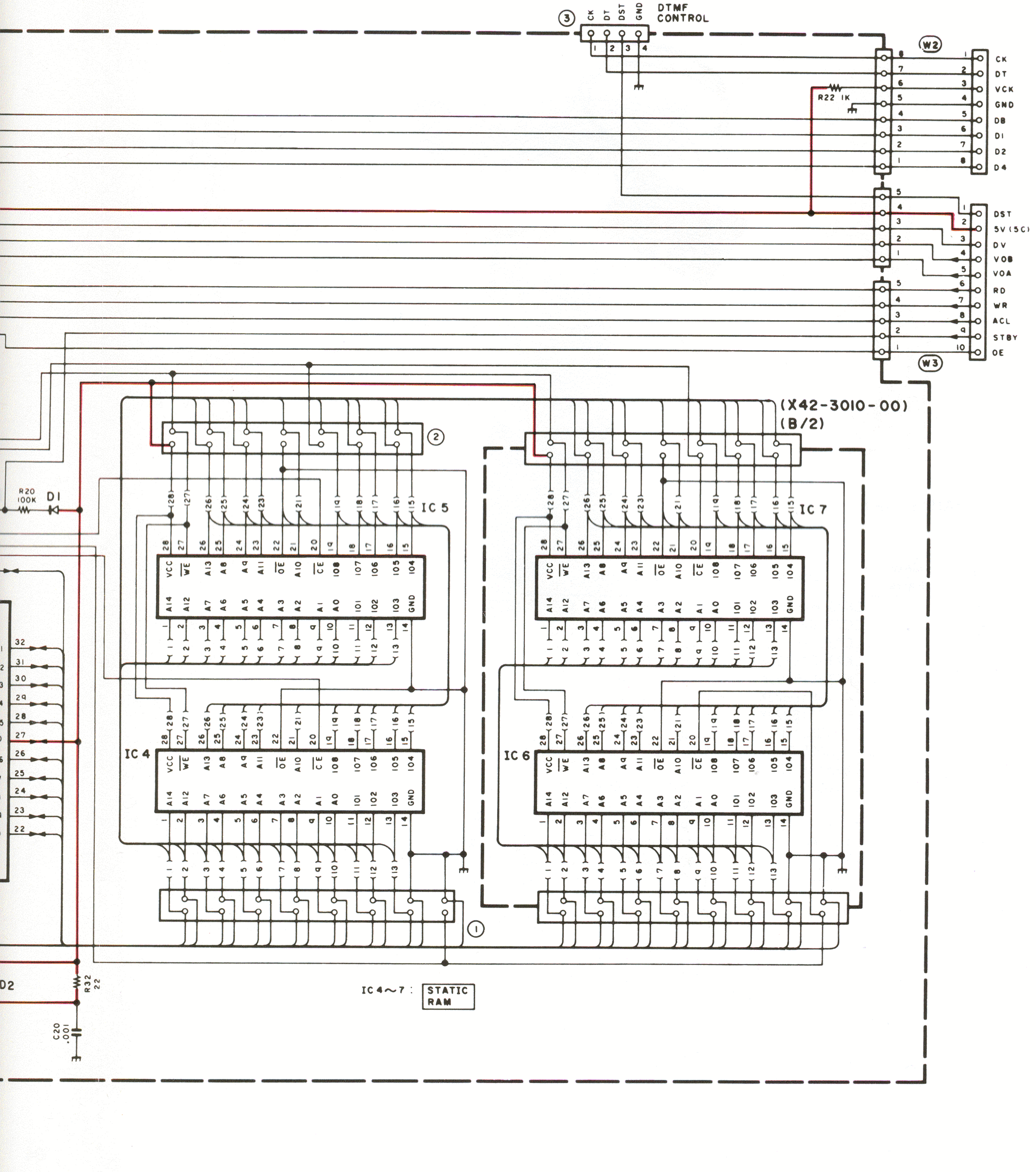

(X42-3010-00) (A/2)
W1
VOA
VO
VI
E
BEEP
IC 1
IC 2
IC 3
IC 4
Q1
Q2
Q3
Q4
Q5
Q6
Q7
D1
D2
X1 3.579545MHz
X2 512KHz
R18 1M
R20 100K
R21 560
R32 22
C20 .001
L1. BATT
MIC INPUT AMP
PLAY AF AMP
2.30V
.621V
0V
ACL
CPUM
VREF
MIC IN
C1
VDD
VSS2
C2
MIC OUT
ADI
DAO
FIL IN
FIL OUT
STBY
X IN
X OUT
256K
R/W
RD
WR

IC1 : TC4052BF
IC2 : LR4102N
IC3 : TC8830AF
IC4~7 : HM62256LFPI-12T

Q1~3,5,6 : 2SC2712(BL)
Q4 : DTC144EK
Q7 : DTC144WK
D1,2 : ISS184

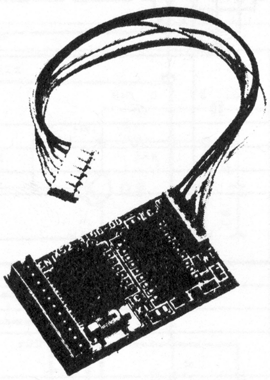
DRU-1 (DIGITAL RECORDING UNIT) TM-241A/E

Pagina 62
Esquema 2 de 2


③
CK DT DST GND
DTMF CONTROL
1 2 3 4
W2
R22 1K
CK
DT
VCK
GND
D8
D1
D2
D4
DST
5V (5C)
DV
VOB
VOA
RD
WR
ACL
STBY
OE
W3
(X42-3010-00)
(B/2)
②
①
IC 5
IC 7
IC 4
IC 6
VCC WE A13 A8 A9 A11 OE A10 CE IO8 IO7 IO6 IO5 IO4
A14 A12 A7 A6 A5 A4 A3 A2 A1 A0 IO1 IO2 IO3 GND
R20 100K
D1
D2
R32 22
C20 .001
32 31 30 29 28 27 26 25 24 23 22
IC4~7 : STATIC RAM

DTU-2 (DTMF UNIT)

DTU-2 EXTERNAL VIEW



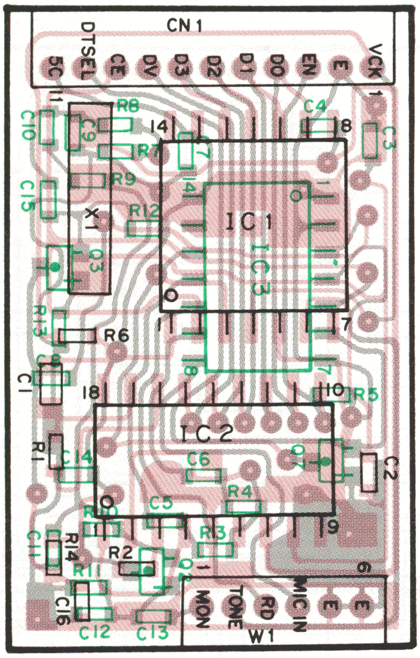
DTU-2 PARTS LIST

Re 5 No.	New Parts	Parts No.	Description
C1		CK73FB1E104K	Chip C 0.1 μF K
C2		CC73GCH1H100D	Chip C 10 pF D
C3,4		CC73GCH1H330J	Chip C 33 pF J
C5~8, 10		CK73GB1E103K	Chip C 0.01 μF K
C13~16		CK73GL1E103K	Chip C 0.01 μF K
C9		CK73GB1E822K	Chip C 0.0082 μF K
C11		CK73GB1E322K	Chip C 0.0033 μF K
C12		CC73GSL1H101J	Chip C 100 pF J
W1		E37-0033-05	Connecting cable (6P)
		E40-5188-05	Pin ass'y socket (11P)
X1		L78-0301-05	CERAMIC RESONATOR (3.58MHz) or L78-0302-05
R1~14		RK73GB1JxxxJ	Chip R
Q1		DTC114EU	Digial transistor
Q2,3		2SC4116 (Y)	Digital transistor
IC1		TP5088WM	IC
IC2		LC7385M	IC
IC3		XRU4066BCF	IC or BU4066BCF

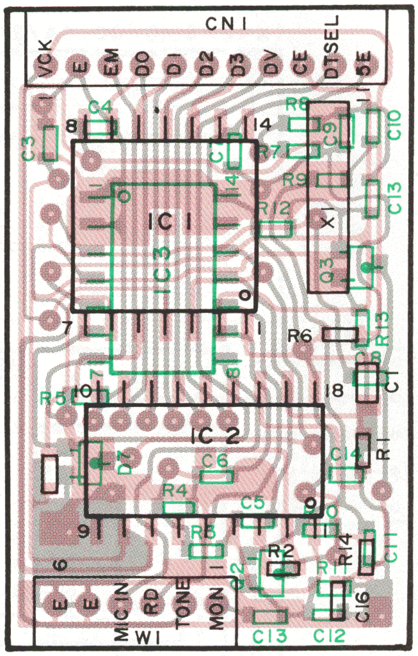
DTU-2 (DTMF UNIT)

DTU-2 PC BOARD

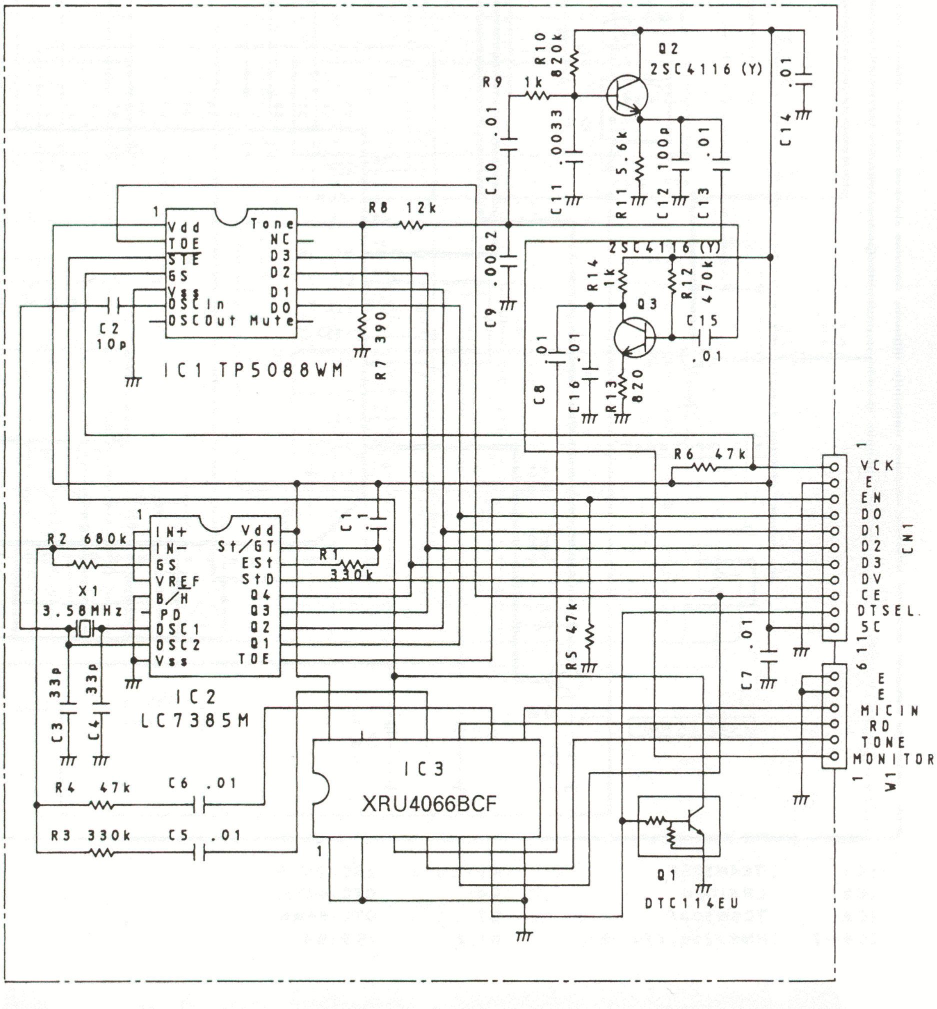
Component side view


CN1
5C
DTSEL
CE
DV
D3
D2
D1
D0
EN
E
VCK
IC1
IC3
IC2
X1
Q1
Q2
Q3
W1
MON
TONE
RD
MIC IN
E
E
C1 C2 C3 C4 C5 C6 C7 C9 C10 C11 C12 C13 C14 C15 C16
R1 R2 R3 R4 R5 R6 R7 R8 R9 R11 R12 R13 R14

Foil side view

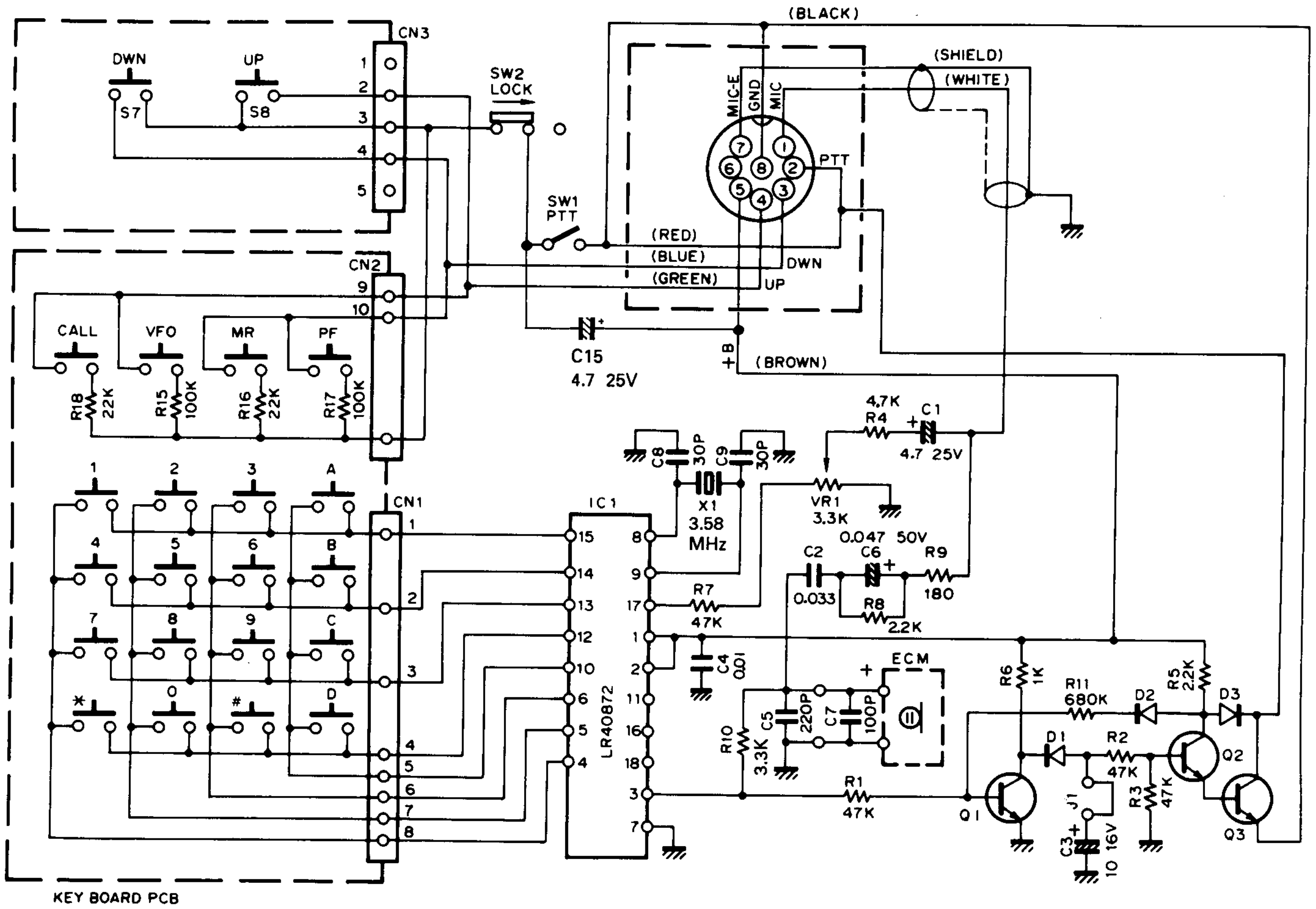

CN1
VCK
E
EN
D0
D1
D2
D3
DV
CE
DTSEL
5C
IC1
IC3
IC2
X1
Q1
Q2
Q3
W1
E
E
MIC IN
RD
TONE
MON
C1 C3 C4 C5 C6 C7 C9 C10 C11 C12 C13 C14 C16
R1 R2 R4 R5 R6 R7 R8 R9 R12 R13 R14

DTU-2 SCHEMATIC DIAGRAM


IC1 TP5088WM
Vdd
TOE
STE
GS
Vss
OSCIn
OSCOut
Tone
NC
D3
D2
D1
D0
Mute
IC2 LC7385M
IN+
IN−
GS
VREF
B/H
PD
OSC1
OSC2
Vss
Vdd
St/GT
ESt
StD
Q4
Q3
Q2
Q1
TOE
IC3
XRU4066BCF
Q1
DTC114EU
Q2
2SC4116 (Y)
Q3
2SC4116 (Y)
X1
3.58MHz
R1 330k
R2 680k
R3 330k
R4 47k
R5 47k
R6 47k
R7 390
R8 12k
R9 1k
R10 820k
R11 5.6k
R12 470k
R13 820
R14 1k
C1 .1
C2 10p
C3 33p
C4 33p
C5 .01
C6 .01
C7 .01
C8 .01
C9 .0082
C10 .01
C11 .0033
C12 100p
C13 .01
C14 .01
C15 .01
C16 .01
CN1
VCK
E
EN
D0
D1
D2
D3
DV
CE
DTSEL
5C
W1
E
E
MIC IN
RD
TONE
MONITOR

MC-44DM/44DME
(MULTI FUNCTION MICROPHONE WITH AUTOPATCH)

MC-44DM/MC-44DME SCHEMATIC DIAGRAM

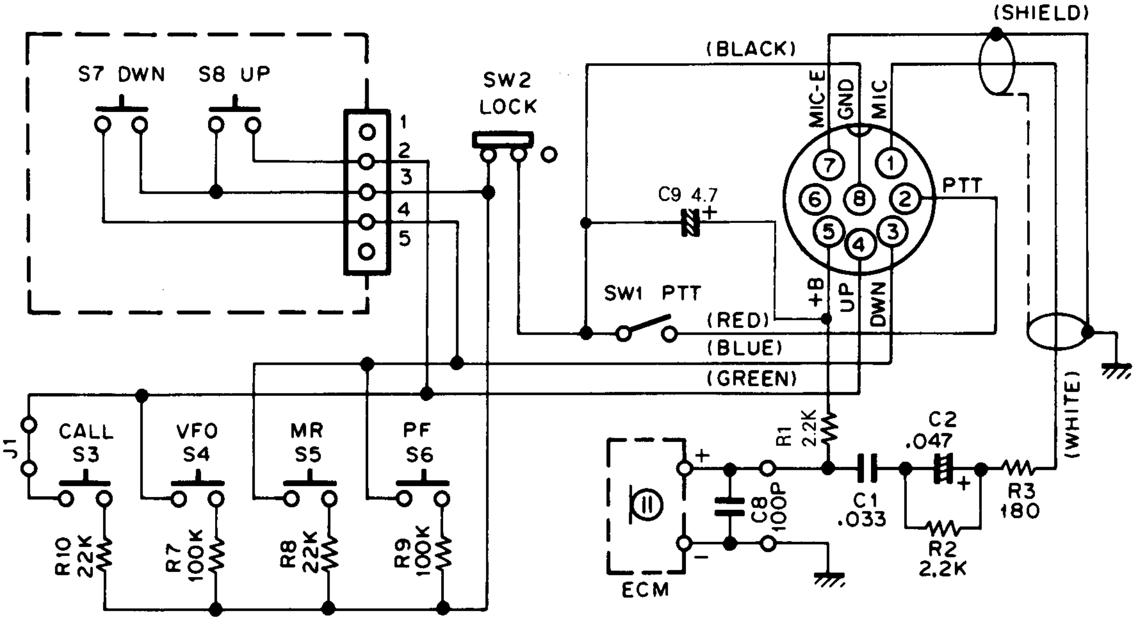

CN3
DWN
UP
S7
S8
SW2
LOCK
SW1
PTT
(BLACK)
(SHIELD)
(WHITE)
MIC-E
GND
MIC
PTT
(RED)
(BLUE)
(GREEN)
DWN
UP
CN2
CALL
VFO
MR
PF
R18 22K
R15 100K
R16 22K
R17 100K
C15
4.7 25V
+B
(BROWN)
4.7K
R4
C1
4.7 25V
C8 30P
C9 30P
X1
3.58 MHz
VR1
3.3K
0.047 50V
C2
C6
R9
180
0.033
R8
2.2K
R7
47K
CN1
IC1
LR40872
C4 0.01
ECM
C5 220P
C7 100P
R10 3.3K
R1
47K
R6 1K
R11
680K
D2
R5 2.2K
D3
D1
R2
47K
R3 47K
Q1
Q2
Q3
J1
C3 10 16V
KEY BOARD PCB

MC-44DM/MC-44DME PARTS LIST

Ref. No.	New parts	Parts No.	Description		
		A02-0898-18	Case (Front)	DTMF	M
		A02-0899-18	Case (Front)	DTMF (With TONE)	W
		A02-0901-08	Case (Rear)	DTMF	
		B50-8293-18	Instruction manual		W
		B50-8289-18	Instruction manual		M
		E30-2149-08	Curl cord		
		G13-0933-08	Cushion		
		K29-3165-08	Knob	PTT	
		K29-3167-18	Key top	DTMF	
		K29-3168-18	Knob	UP	
		K29-3169-18	Knob	DOWN	
SW2		S31-1422-08	Slide switch	LOCK	
SW1		S50-1431-08	Micro switch	PTT	
S7, 8		S59-1409-28	Switch	UP, DOWN	
		T91-0383-08	Microphone element (Condenser microphone)		

MC-44 (MULTI FUNCTION MICROPHONE)

MC-44 SCHEMATIC DIAGRAM

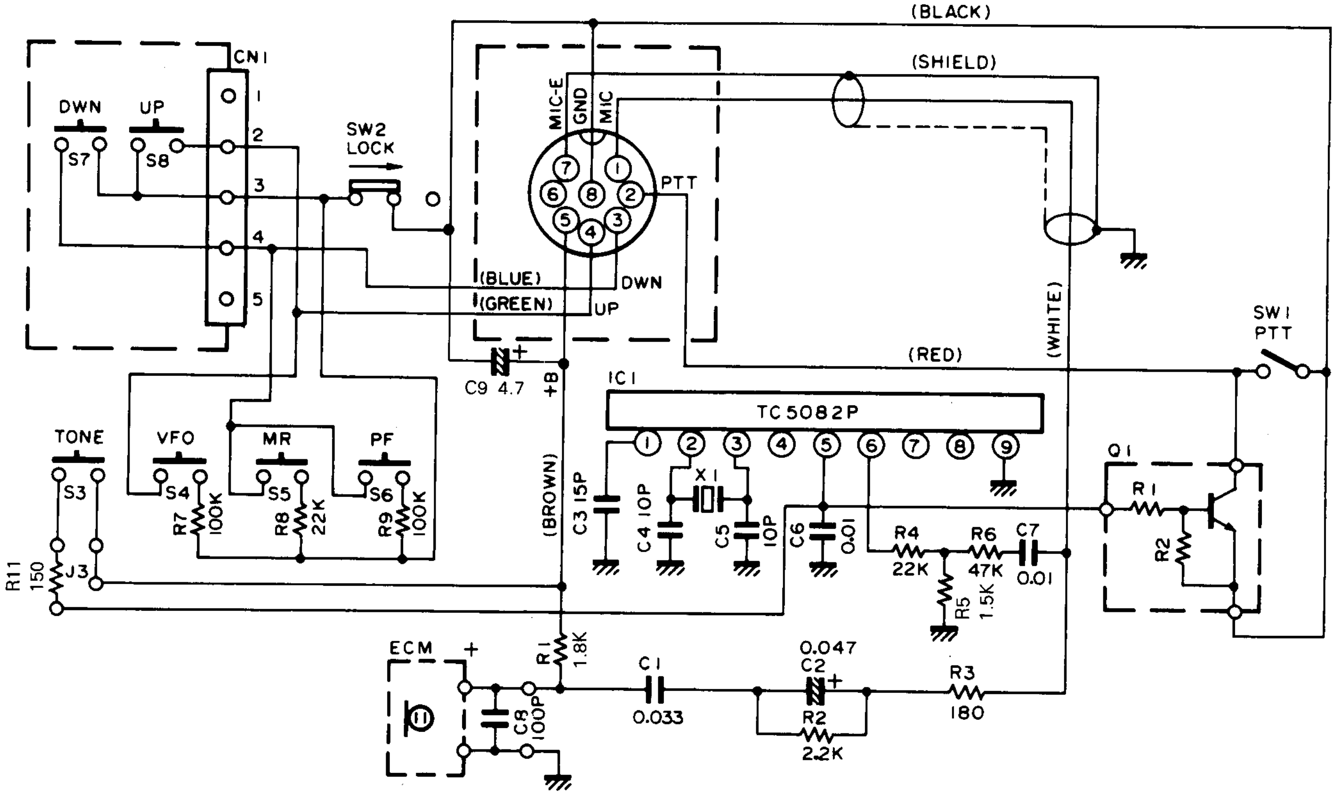

S7 DWN
S8 UP
1
2
3
4
5
SW2
LOCK
(SHIELD)
(BLACK)
MIC-E
GND
MIC
⑦
⑧
①
⑥
②
⑤
④
③
PTT
C9 4.7
SW1 PTT
(RED)
(BLUE)
(GREEN)
+B
UP
DWN
J1
CALL
S3
VFO
S4
MR
S5
PF
S6
R10
22K
R7
100K
R8
22K
R9
100K
R1
2.2K
C2
.047
C8
100P
C1
.033
R2
2.2K
R3
180
(WHITE)
ECM

MC-44 PARTS LIST

Ref. No.	New parts	Parts No.	Description
		A02-0896-18	Case (Front)
		A02-0900-08	Case (Rear)
		B50-8293-18	Instruction manual
		E30-2149-08	Curl cord
		G13-0933-08	Cushion
		K29-3165-08	Knob PTT
		K29-3168-18	Knob UP
		K29-3169-18	Knob DOWN
		K29-3170-08	Knob CALL, VFO, MR, PF
SW2		S31-1422-08	Slide switch LOCK
SW1		S50-1431-08	Micro switch PTT
S7, 8		S59-1409-28	Switch UP, DOWN
		T91-0383-08	Microphone element (Condenser microphone)

MC-44E (MULTI FUNCTION MICROPHONE)

MC-44E SCHEMATIC DIAGRAM

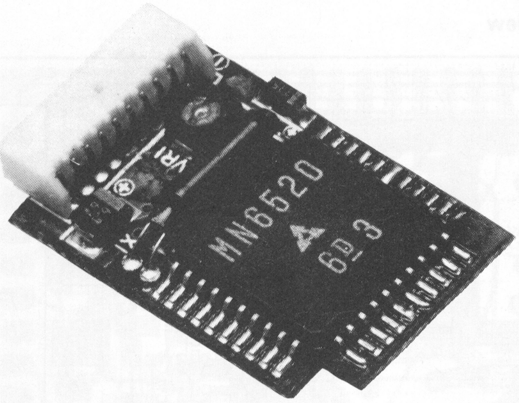

(BLACK)
(SHIELD)
CN1
DWN
UP
S7
S8
SW2
LOCK
MIC-E
GND
MIC
PTT
(BLUE)
(GREEN)
DWN
UP
(WHITE)
(RED)
SW1
PTT
C9 4.7
+B
IC1
TC5082P
TONE
VFO
MR
PF
S3
S4
S5
S6
R7 100K
R8 22K
R9 100K
(BROWN)
C3 15P
C4 10P
X1
C5 10P
C6 0.01
R4 22K
R6 47K
C7 0.01
R5 1.5K
Q1
R1
R2
R11 150
J3
ECM
R1 1.8K
C8 100P
C1 0.033
0.047 C2
R2 2.2K
R3 180

MC-44E PARTS LIST

Ref. No.	New parts	Parts No.	Description
		A02-0897-18	Case (Front) With TONE
		A02-0900-08	Case (Rear)
		B50-8293-18	Instruction manual
		E30-2149-08	Curl cord
		G13-0933-08	Cushion
		K29-3165-08	Knob PTT
		K29-3168-18	Knob UP
		K29-3169-18	Knob DOWN
		K29-3170-08	Knob 1750, VFO, MR, PF
SW2		S31-1422-08	Slide switch LOCK
SW1		S50-1431-08	Micro switch PTT
S7, 8		S59-1409-28	Switch UP, DOWN
		T91-0383-08	Microphone element (Condenser microphone)

TSU-6 (CTCSS UNIT)

TSU-6 EXTERNAL VIEW



TSU-6 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		CTCSS UNIT (X52-3100-00)	
C1		CK73FB1H102K	Chip C 1000pF K
C2		C92-0507-05	Tantal 4.7μF 6.3WV
C3		C92-0520-05	Tantal 22μF 4.0WV
C4, 5		CK73EB1E104K	Chip C 0.1μF K
C6		CK73EB1H223K	Chip C 0.022μF K
C7		CK73EB1E104K	Chip C 0.1μF K
C8, 9		CC73FCH1H150J	Chip C 15pF J
C10		CK73FB1H102K	Chip C 1000pF K
C11		CK73FB1E473K	Chip C 0.047μF K
C12		C92-0507-05	Chip tan. 4.7μF 6.3WV
C13		C92-0534-05	Chip tan. 33μF 4.0WV
CN1		E40-5121-05	Pin connector (10P)
X1		L77-1313-05	X'tal resonator 4.194304MHz
R1–10		RK73FB2A○○○J	Chip resistor
R12–14		RK73FB2A○○○J	Chip resistor
VR1		R12-3460-05	Trimming pot. 33kΩ
Q1		DTC144TK	Digital transistor
Q2		DTA114EK	Digital transistor
Q3		2SC2712(GR)	Chip transistor
IC1		MN6520	IC
IC2		MN4094BS	IC

TSU-6 FINE ADJUSTMENT OF TONE FREQUENCY

The tone frequency can be fine adjusted with an interval of 0.5% step over the range of 0 to +1.5%. Ground the T1 (pin 10) and T2 (pin 9) of IC1 to obtain the desired frequency.

	T1	T2
0%	X	X
+0.5%	○	X
+1.0%	X	○
+1.5%	○	○

○ : GND, X : OPEN

Table 2

TSU-6 REFERENCE DATA

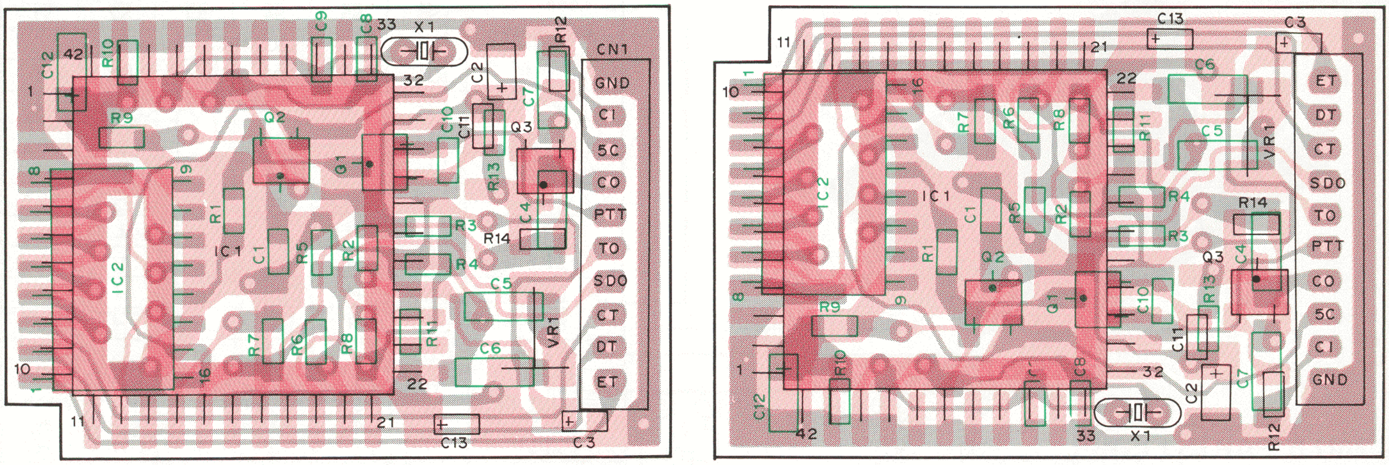
Tone frequency and MN6520 (IC1) relationship

Tone frequency (Hz)	MN6520 terminal					
	$\overline{S6}$	$\overline{S5}$	$\overline{S4}$	$\overline{S3}$	$\overline{S2}$	$\overline{S1}$
	MN4094BS terminal					
	Q1	Q2	Q3	Q4	Q7	Q8
67.0	L	H	H	H	L	H
71.9	L	H	H	H	L	L
74.4	L	H	H	L	H	H
77.0	L	H	H	L	H	L
79.7	L	H	H	L	L	H
82.5	L	H	H	L	L	L
85.4	L	H	L	H	H	H
88.5	L	H	L	H	H	L
91.5	L	H	L	H	L	H
94.8	H	H	H	L	L	H
100.0	H	H	H	L	L	L
103.5	H	H	L	H	H	H
107.2	H	H	L	H	H	L
110.9	H	H	L	H	L	H
114.8	H	H	L	H	L	L
118.8	H	H	L	L	H	H
123.0	H	H	L	L	H	L
127.3	H	H	L	L	L	H
131.8	H	H	L	L	L	L
136.5	H	L	H	H	H	H
141.3	H	L	H	H	H	L
146.2	H	L	H	H	L	H
151.4	H	L	H	H	L	L
156.7	H	L	H	L	H	H
162.2	H	L	H	L	H	L
167.9	H	L	H	L	L	H
173.8	H	L	H	L	L	L
179.9	H	L	L	H	H	H
186.2	H	L	L	H	H	L
192.8	H	L	L	H	L	H
203.5	H	L	L	H	L	L
210.7	H	L	L	L	H	H
218.1	H	L	L	L	H	L
225.7	H	L	L	L	L	H
233.6	H	L	L	L	L	L
241.8	L	H	H	H	H	H
250.3	L	H	H	H	H	L

Table 1

TSU-6 (CTCSS UNIT)

TSU-6 PC BOARD VIEWS


Component side view

Foil side view

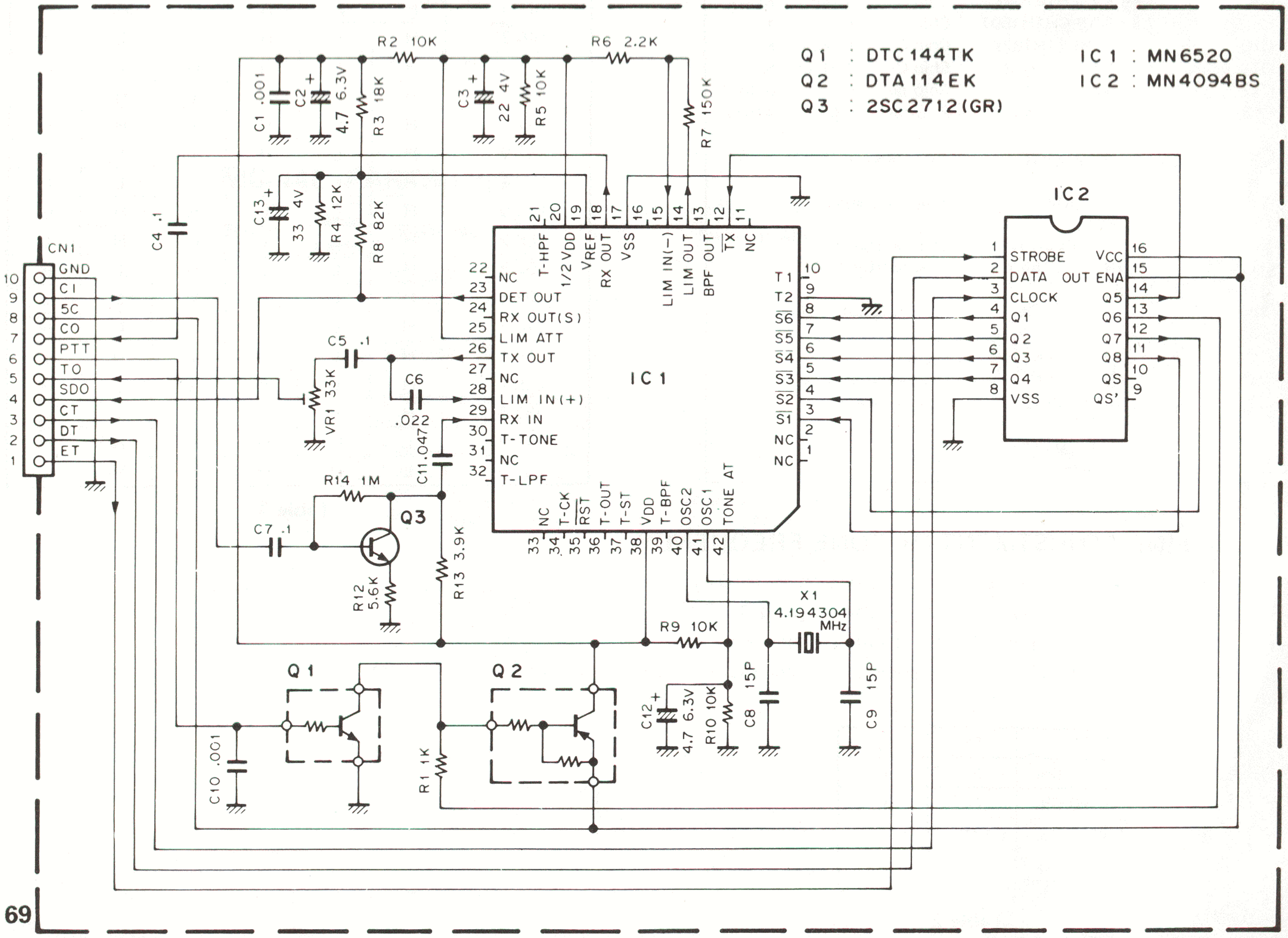
CN1
GND
CI
5C
CO
PTT
TO
SDO
CT
DT
ET
IC1
IC2
Q1
Q2
Q3
X1
VR1
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
1
8
9
10
11
16
21
22
32
33
42

▨ : Component side

▨ : Foil side

TSU-6 CIRCUIT DIAGRAM

CTCSS UNIT(X52-3100-00)



Q1 : DTC144TK
Q2 : DTA114EK
Q3 : 2SC2712(GR)
IC1 : MN6520
IC2 : MN4094BS
R2 10K
R6 2.2K
C1 .001
C2 + 4.7 6.3V
R3 18K
C3 + 22 4V
R5 10K
R7 150K
C13 + 33 4V
R4 12K
R8 82K
C4 .1
C5 .1
C6 .022
VR1 33K
C11 .047
R14 1M
C7 .1
Q3
R12 5.6K
R13 3.9K
R9 10K
X1 4.194304 MHz
C12 + 4.7 6.3V
R10 10K
C8 15P
C9 15P
Q1
Q2
R1 1K
C10 .001
CN1
10 GND
9 CI
8 5C
7 CO
6 PTT
5 TO
4 SDO
3 CT
2 DT
1 ET
IC1
21 T-HPF
20 1/2VDD
19 VREF
18 RX OUT
17 VSS
16
15 LIM IN(−)
14 LIM OUT
13 BPF OUT
12 TX
11 NC
22 NC
23 DET OUT
24 RX OUT(S)
25 LIM ATT
26 TX OUT
27 NC
28 LIM IN(+)
29 RX IN
30 T-TONE
31 NC
32 T-LPF
33 NC
34 T-CK
35 RST
36 T-OUT
37 T-ST
38 VDD
39 T-BPF
40 OSC2
41 OSC1
42 TONE AT
10 T1
9 T2
8 S6
7 S5
6 S4
5 S3
4 S2
3 S1
2 NC
1 NC
IC2
1 STROBE
2 DATA
3 CLOCK
4 Q1
5 Q2
6 Q3
7 Q4
8 VSS
16 VCC
15 OUT ENA
14 Q5
13 Q6
12 Q7
11 Q8
10 QS
9 QS'

SPECIFICATIONS

General

Frequency range	136 to 174MHz : TM-241A (M2,M3), TM-241E (E2) 144 to 148MHz : TM-241A (K,K2,P,P2,X,M) 144 to 146MHz : TM-241E (E,E9,EM)
Mode	F3E (FM)
Antenna impedance	50Ω
Power requirements	13.8V DC ± 15% (11.7 to 15.8V)
Ground	Negative
Frequency stability	Less than ±10ppm
Current drain	Transmit mode : Less than 11A Receive mode with no signal : Less than 0.6A
Operating temperature	–20°C to +60°C (–4°F to +140°F)
Dimensions (W x H x D)	140 x 40 x 160 mm (5-1/2" x 1-37/64" x 6-19/64")
Projection included	140 x 40 x 172 mm (5-1/2" x 1-37/64" x 6-25/32")
Weight	1.2kg (2.65lbs)

Transmitter

Output power*	HI : 50W MID : Approx. 10W LOW : Approx. 5W
Modulation	Reactance modulation
Spurious radiation	Less than –60dB
Maximum frequency deviation	±5kHz
Audio distortion (at 60% modulation)	Less than 3% (300 to 3000Hz)
Microphone impedance	600Ω

Receiver

Circuitry	Double conversion superheterodyne
Intermediate frequency (1st/2nd)	10.7MHz/455kHz : TM-241A (K,P,X,M,M2,M3), TM-241E (E,E2,E9,EM) 30.825MHz/455kHz : TM-241A (K2,P2)
Sensitivity (12dB SINAD)	Less than 0.16μV : TM-241A (K,P,X,M,M2,M3), TM-241E (E,E2,E9,EM) Less than 0.22μV : TM-241A (K2,P2)
Selectivity	–6dB : More than 12kHz –60dB : Less than 24kHz
Squelch sensitivity	Less than 0.1μV
Output (5% distortion)	More than 2W across 8Ω loads
External speaker impedance	8Ω

Notes :
1. Circuit and ratings are subject to change without notice due to advancements in technology.
2. *Recommended duty cycle : 1 minute transmit, 3 minutes reception.

KENWOOD CORPORATION
14-6, Dogenzaka 1-chome, Shibuya-ku, Tokyo 150, Japan
KENWOOD SERVICE CORPORATION
P.O. BOX 22745, 2201 East Dominguez Street, Long Beach, CA 90801-5745, U.S.A.
KENWOOD ELECTRONICS DEUTSCHLAND GMBH
Rembrücker Str. 15, 6056 Heusenstamm, Germany
KENWOOD ELECTRONICS BENELUX N.V.
Mechelsesteenweg 418 B-1930 Zaventem, Belgium
TRIO-KENWOOD FRANCE S.A.
13, Boulevard Ney, 75018 Paris, France
TRIO-KENWOOD U.K. LIMITED
KENWOOD House, Dwight Road, Watford, Herts., WD1 8EB United Kingdom
KENWOOD ELECTRONICS NEDERLAND B.V.
Amsterdamseweg 35, 1422 AC Uithoorn, The Netherlands
KENWOOD ELECTRONICS ITALIA S.p.A.
Via G. Sirtori, 7/9 20129 Milano, Italy
KENWOOD ESPAÑA S.A.
Bolivia, 239-08020 Barcelona, Spain
KENWOOD ELECTRONICS AUSTRALIA PTY. LTD.
(A.C.N. 001 499 074)
P.O. Box 504, 8 Figtree Drive, Australia Centre, Homebush, N.S.W. 2140, Australia
KENWOOD & LEE ELECTRONICS, LTD.
Unit 3712-3724, Level 37, Tower one Metroplaza, 223 Hing Fong Road, Kwai Fong, N.T., Hong Kong
KENWOOD ELECTRONICS CANADA INC.
6070 Kestrel Road, Mississauga, Ontario, Canada L5T 1S8